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STSC

Software Configuration Management Technology Report

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Preface

Software Configuration Management (SCM) is the backbone of the software development process, and when implemented correctly, helps ensure software quality and process improvement. Use of this report should be the first step in transferring effective SCM principles, processes, and products into practical use.

This report defines the basic principles of SCM and identifies their value in improving software quality. SCM adoption issues are discussed, and guidance is provided for the development of a long-term SCM solution. This report emphasizes the need for organizations to plan for the SCM implementation, to develop a detailed SCM plan, and to define the SCM process before implementing an automated SCM system. Information about SCM products in the marketplace is also included. Finally, future directions of the SCM domain are identified.

Audience

The target audience consists of software engineers and technical managers responsible for ensuring the successful adoption of SCM in their organization.

Scope

This report addresses SCM issues that concern Air Force agencies developing embedded software by presenting an overview of SCM technology and by providing references for those who wish to study the subject in more detail. A detailed SCM tutorial is beyond the scope of this document. Information presented concentrates on SCM technology for software engineers responsible for developing and maintaining medium to large-scale software systems. Other DoD organizations should find the majority of the information useful as well.

Acknowledgments

The Software Technology Support Center (STSC) Software Configuration Management Team expresses special thanks to members of the Computer Aided Software Engineering (CASE) Environments Project at the Software Engineering Institute (SEI) at Carnegie Mellon University (CMU). Their technical reports and briefings provided the majority of information for this report. A special note of appreciation to Susan Dart, formerly of the SEI, who provided insight into the problems organizations face when implementing an SCM solution. In addition, the Software Configuration Management Team wishes to thank all those individuals within the STSC who contributed to the development of the SCM Technology Report.

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1.1 Purpose and Overview

Software Configuration Management is the discipline for managing the evolution of computer program products during all stages of development and maintenance. SCM spans all areas of the software lifecycle. Adopting SCM in an organization is complex, since both managerial and technical issues must be addressed. Adopting SCM technology is the most difficult kind of adoption due to the complexity of the SCM solution and the number of people involved. It impacts all data and processes. The purpose of this report is to provide current information on SCM principles, methods, and technologies.

Interest in SCM has increased dramatically in the last two years. This interest can be largely attributed to SEI's Capability Maturity Model (CMM), which identifies SCM as a Level 2 Key Process Area (see Appendix A for a brief description of the CMM). The CMM is requiring that the Air Force address SCM issues in their software development organizations. Software Configuration Management plays an important part at every level of process maturity.

There is a wealth of information available on SCM. This information includes the following:

- Technical reports produced by SEI's Software Engineering Environments Team
- Reports developed by the Software Technology for Adaptable, Reliable Systems (STARS) program
- Recently published SCM books and articles
- IEEE software standards
- Government standards.

This report provides an overview of SCM information and includes references for a more detailed study of SCM. The following will be presented:

- Tutorial outlining the basic SCM concepts
- Current SCM practices
- Features found in SCM tools
- SCM adoption issues
- Future directions of the SCM domain
- SCM products and related information.

1.2 Basic Concepts

Software Configuration Management is a discipline for managing the evolution of computer products, both during the initial stages of development and all stages of maintenance. A more detailed definition is found in the CMM and is listed below.

> "Software Configuration Management involves identifying the configuration of the software (i.e., selected software work products and their descriptions) at given points in time, systematically controlling changes to the configuration, and maintaining the integrity and traceability of the configuration throughout the software lifecycle. The work products placed under software configuration management include the software products that are delivered to the customer (e.g., the software requirements document and the code) and the items that are identified with or required to create these software products (e.g., compiler)" [Paulk 93].

SCM provides visibility into the status of the evolving software product. Software developers, testers, project managers, Quality Assurance (QA) personnel, and the customer benefit from SCM information. SCM answers the following: *Who, What, When,* and *Why*.

- *Who made the changes?*
- *What changes were made to the software?*
- *When were the changes made?*
- *Why were the changes made?*

SCM is divided into the following functional areas: Identification, Change Control, Status Accounting, and Audit. (see Figure 1.2).

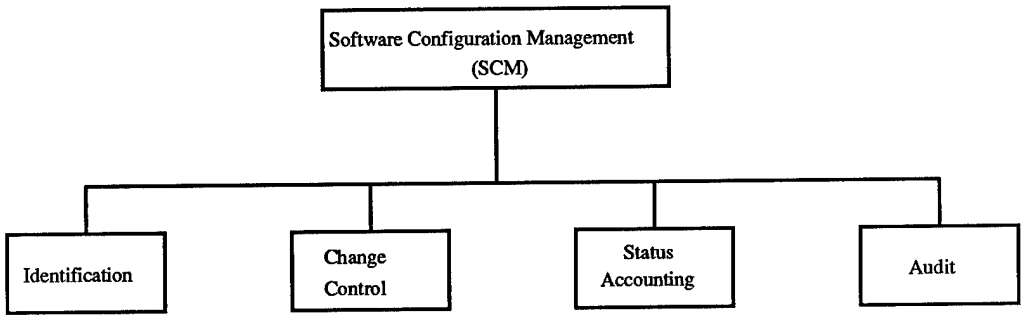

Figure 1.2 Software Configuration Management

1.2.1 Configuration Identification

Identification involves identifying the structure of the software system, uniquely identifying individual components, and making them accessible in some form. The goal of Identification is to have the ability to identify the components of a system throughout its lifecycle and provide traceability between the software and related software products. Identification answers the following: *What is the configuration of my system? What version of the file is this?* and *What are the components of the system?*

Identification Activities:

- Selecting items to be placed under SCM control

- Developing the software hierarchy
- Creating an identification scheme that reflects the software hierarchy
- Uniquely identifying the various revisions of the software product
- Defining relationships and interfaces between the various software products.

Figure 1.2.1 presents a typical breakdown of software into its distinct parts and presents a numbering scheme uniquely identifying each component.

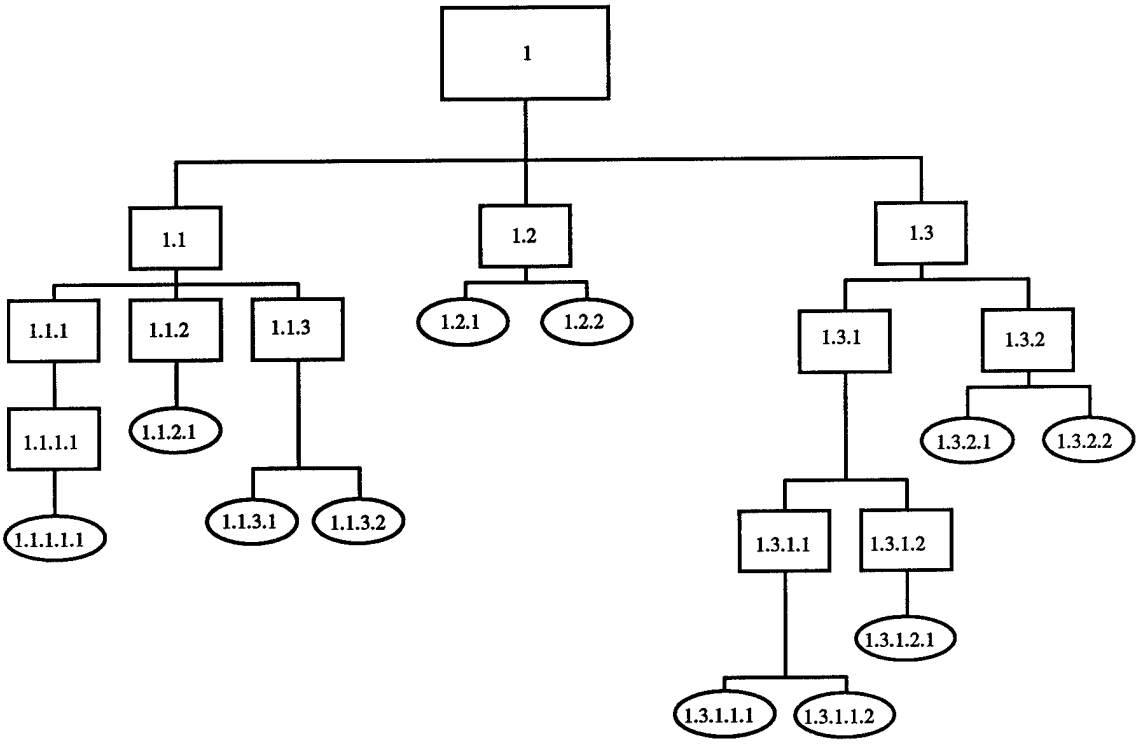

Figure 1.2.1 Software Configuration Identification Hierarchy

Although the key component to be managed is the source code, related documentation and data should be identified and placed under SCM control. It is important to store and track all environment information and support tools used

throughout the software lifecycle to ensure that the software can be reproduced. The following are examples of items typically put under SCM control:

- Support Software (software required to build and maintain the software throughout its lifecycle) such as:
  - System Build Files
  - Compilers
  - Operating System
  - Link/Loaders
  - Procedure Languages
  - Shell Scripts
- Object Code
- CASE Elements
- Documentation
  - Requirements
  - Specifications
  - Design
  - Interface Control
  - User
- Software Development Folders
- Libraries
- Project Plans
- Test Plans/Procedures
- Test Data
- SCM Plans/Procedures
- Problem/Enhancement Reports
- Hardware Platform Information
- SCM Reports
- Third-party Tools.

1.2.2 Configuration Change Control

Configuration Change Control involves controlling the release and changes to software products throughout the software lifecycle. The goal of Change Control is to establish mechanisms that will help ensure the production of quality software. A generic change process is identified in Figure 1.2.2.

Change Control answers the following: *What is controlled? How the changes to the products are controlled?* and *Who controls the changes?*

Change Control Activities:

- Defining the change process
- Establishing change control policies and procedures
- Maintaining baselines
- Processing changes
- Developing change report forms
- Controlling release of the product.

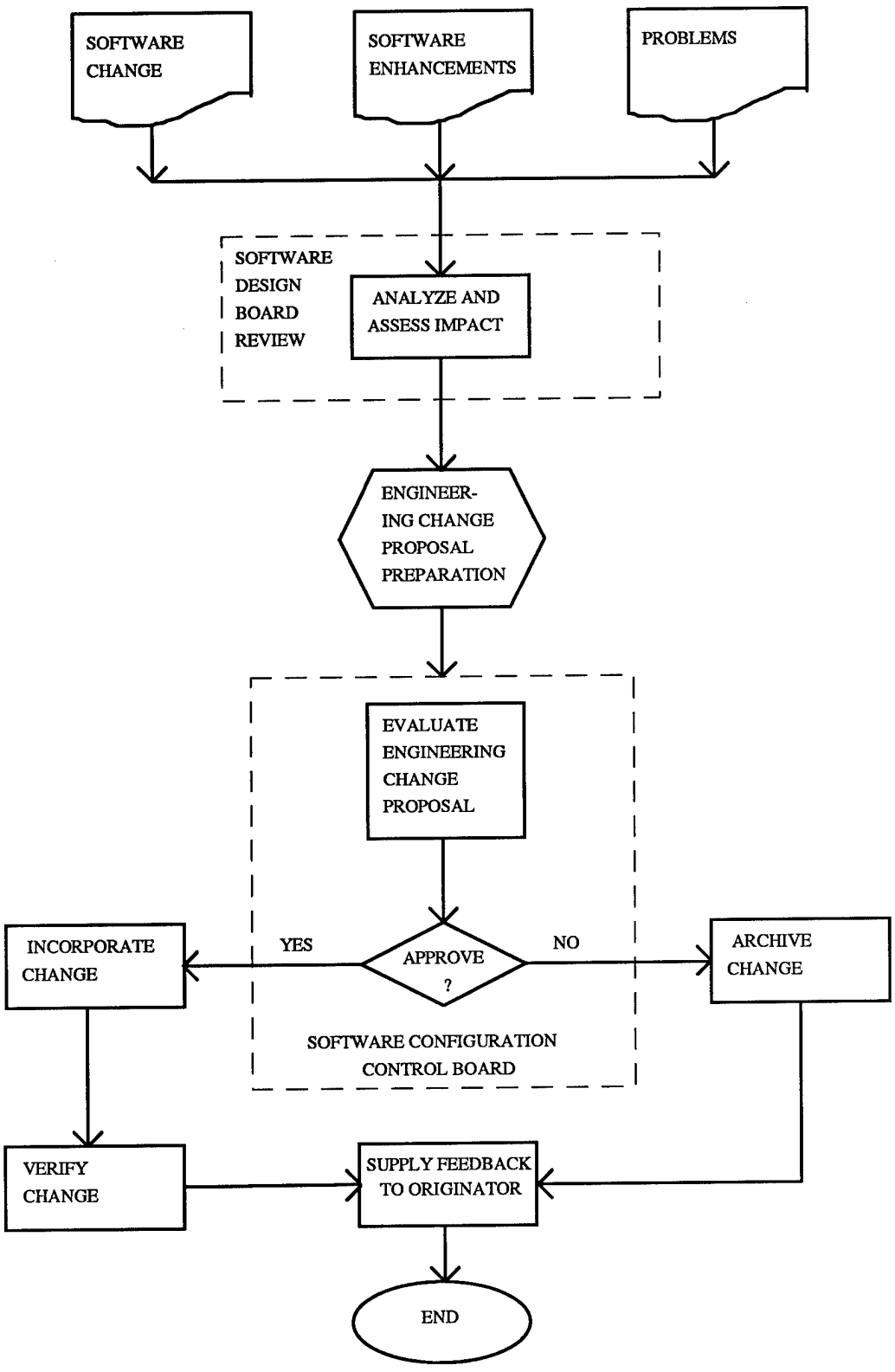

Figure 1.2.2 Generic Change Process

The baseline is a key concept of SCM. A baseline is "a specification or product that has been formally reviewed and agreed upon, that thereafter serves as the basis for further development, and that can be changed only through formal change procedures" [IEEE 90]. When an item is baselined, it becomes frozen - the item can only be changed by creating a new version. DoD-STD-2167A, the AF standard for embedded software development, defines the different types of baselines, identifies items included in the baseline, and specifies when baselines are created. In addition, several informal baselines are usually established during the software development process. The number and type of baselines depend on which life cyle model the project is implementing. Lifecycle models, such as the spiral, incremental development, and rapid prototyping, require more flexibility in the establishment of baselines. For a detailed explanation of lifecycle models, see *Wicked Problems, Righteous Solutions* by Peter DeGrace and Leslie Houlet Stahl.

1.2.3 Configuration Status Accounting

Configuration Status Accounting involves the recording and reporting of the change process. The goal of status accounting is to maintain a status record of all items in a baseline, thus providing the traceabiltiy of all changes to the baseline throughout the software lifecycle. Status Accounting answers the following: *What changes have been made to the system?* and *How many files were affected by this problem report?*

Status Accounting Activities:

- Determining type of logs and reports required
- Tracking the status of SCM items
- Tracking the status of changes to the system
- Generating status reports
- Recording and reporting the activities of SCM.

1.2.4 Configuration Audit

Configuration Audit verifies that the software product is built according to the requirements, standards, or contractual agreement. Test reports and documentation are used to verify that the software meets the stated requirements. The goal of Configuration Audit is to verify that all software products have been produced, correctly identified and described, and that all change requests have been resolved. Informal audits are conducted at key phases of the software lifecycle. There are two types of formal audits that are conducted before the software is delivered to the customer: Functional Configuration Audit (FCA) and Physical Configuration Audit (PCA). FCA verifies that the software actually satisfies the software requirements stated in the System Requirements Specification and the Interface Requirements Specification. PCA determines whether or not the design and reference documents represent the software that was built. Configuration audit answers the following: *Does the system satisfy the requirements? and Are all changes incorporated in this version?*

Configuration Audit Activities:

- Defining audit schedule and procedures
- Performing audits on the established baselines
- Generating audit reports.

1.2.5 Establishing a Software Baseline Library

In support of the above activities, a software baseline library is established. The library is the heart of the SCM system. It serves as the repository for the work products created during the software lifecycle. Changes to baselines, and the release of software products, are systematically controlled via the change control and configuration auditing functions.

The Software Library:

- Supports multiple control levels of SCM
- Provides for the storage and retrieval of configuration items/units
- Provides for the sharing and transfer of configuration items/units between control levels within the library
- Provides for the storage and recovery of archive versions of configuration items/units
- Helps to ensure correct creation of products from the software baseline library
- Provides storage, update, and retrieval of SCM records
- Supports production of SCM reports
- Provides for the maintenance of the library structure [Olson 93].

In the past, libraries have been composed of documentation on hard copy and software on machine-readable media. Today, with the advances in information technology and the Computer-Aided Acquisition and Logistic Support (CALS) standard that requires contractors to use automated processing and electronic submittal techniques, organizations are moving towards maintaining all information on machine-readable media. Additional information on SCM basic concepts can be found in *Software Configuration Management* by Ron Berlack and *Implementing Configuration Management Hardware, Software, and Firmware* by Fletcher Buckley.

1.3 Software Configuration Management Tools

This section describes UNIX SCM utilities and details features found in state-of-the-art SCM tools.

1.3.1 UNIX Utilities

Many state-of-the-art SCM tools have their roots in the development of the UNIX utilities Source Code Control System (SCCS), Revision Control System (RCS), and *Make*. SCCS and RCS provide version control and baseline management. SCCS is distributed with most AT&T versions of UNIX, and RCS is available via the Internet. They were both designed to control source code, but can be used to store other data. SCCS and RCS serve as the repository in the commonly implemented Check-out/Check-in SCM model (see Figure 1.3.1). The basic concept of the Check-out/Check-in model is as follows:

To modify an item the developer:

1. Checks the item out from the repository (Check-out)
2. Incorporates the changes
3. Checks the item back into the repository (Check-in).

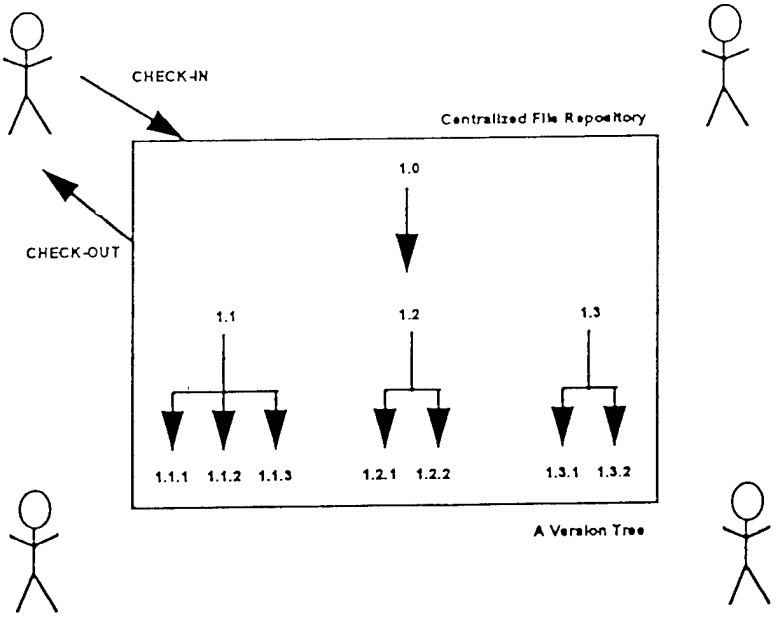

Figure 1.3.1

When an item is checked out, it is locked to prevent developers from simultaneously making changes to the same item. SCCS and RCS utilize variations of the delta storage scheme to save disk space. Delta storage involves storing only the changes between each version. SCCS implements the forward delta scheme that involves storing the initial baseline and the differences between each baseline. RCS uses reverse delta storage that involves storing the latest version along with the differences between each previous baseline. Reverse delta storage provides a more efficient retrieval of the latest version because the latest version is maintained.

The UNIX utility, *Make,* was developed to automate the build process. Building of a large software system can be a tedious and error-prone process. Special care must be taken to assure that the correct version of each module is included in the build. *Make* builds an executable image from source and object code and stores the dependencies between modules and the rules to build the system. It identifies changed modules and dependencies and rebuilds only those modules.

1.3.2 SCM Tool Features

Many companies are expanding the functionality of their tools to meet the requirements of today's software development organizations. Several companies sell their products as a series of building blocks. For example, the base product handles version control and process control, while the problem reporting function may be purchased separately.

State-of-the-art SCM tools may have all or combinations of the following features:

- Version Control
- Configuration Support

- Process Support
- Change Control
- Team Support
- Library/Repository Support
- Security/Protection
- Reporting/Query
- Tool Integration
- Build Support
- Release Management
- Customization Support
- Graphical User Interfaces (GUIs)

1.3.2.1 Version Control

Version Control is a basic requirement for an SCM tool. It ensures repeatability - the ability to reproduce any version of the software at any given time. Version Control involves controlling the different versions of software, uniquely identifying versions and configurations, and providing version change history to ensure traceability. Several tools incorporate advanced version schemes that support parallel development activities.

1.3.2.2 Configuration Support

A configuration is a collection of components that fulfill a particular purpose. Tools provide mechanisms that enable the user to correctly identify and model the software system as well as track relationships between items in the configuration. To establish traceability between components, tools allow users to establish links between components (e.g., link requirements to source code and test cases). Several tools support impact analysis by scanning for dependencies between items. Managing the complexity of the dependency between items is an important aspect of SCM.

1.3.2.3 Process Support

A process details how the various members of the organization (i.e., developer, tester, manager, QA personnel) use the system throughout the software lifecycle. Process controls ensure that the proper steps are executed in the correct order by the authorized person. Several tools include a predefined lifecycle model and provide mechanisms to ensure the proper steps are completed at each stage of the lifecycle. For example, a tool may specify a five-phase development process: analysis, design, development, test, and final release. Tools commonly implement process controls by allowing the user to define *Triggers*. *Triggers* execute user-defined scripts prior to, or in response to, certain events, (e.g., when a component is checked out from the repository, an E-mail message is sent to notify other team members). Some tools allow users to define roles and responsibilities. More flexible tools provide lifecycle models and control mechanisms that can be tailored to meet each organization's special needs. Several tools have methods that allow the user to bypass process steps to perform emergency maintenance.

1.3.2.4 Change Control

Change control involves controlling the changes to the software throughout the software lifecycle. A change reporting system manages change reports and provides traceability between the change request and the items that are being changed. Several vendors have incorporated change reporting features in their products. Others have provided interfaces with third party change reporting systems. Information collected from change reports facilitates the collection of metrics. Several tools provide standard change forms and allow the user to customize the form to meet the project's requirements. Advanced tools provide an on-line display of the change form.

1.3.2.5 Team Support

Team Support involves:

- Controlling interactions between the various team members
- Providing programmers with an isolated workspace
- Supporting parallel development
- Supporting programmers who work at distributed sites.

An example of controlling interactions between members of a team would be the automatic sending of an E-mail message that notifies team members of modifications to a particular module.

Providing an isolated workspace involves mechanisms that allow programmers to work without interfering with other members of the programming team.

Parallel development generally involves multiple programmers working on the same module or set of modules. For example, one programmer is fixing a bug in a module while another programmer is working on enhancing that module for the next release. Until recently, parallel development was done on a limited basis. Now, because software is developed at diverse sites on a variety of software and hardware platforms and is targeted for different machines, parallel development is becoming standard practice for many organizations. Tools that support parallel development must also provide improved mechanisms that will:

- Control access to the repository
- Notify team members of the changes taking place
- Identify the differences between versions
- Merge versions.

Distributed development involves support for transferring of data over networks and synchronizing changes to the software system made at different locations.

1.3.2.6 Library/Repository

The library or repository captures SCM information and stores versions of items. Several tools store data in a proprietary database, others build functionality on top of commercial databases such as Oracle, Sybase, and Ingress. Several SCM tools also allow the user to select from several databases. Tools provide mechanisms that create an audit trail of all SCM activities and database transactions.

1.3.2.7 Security/Protection

To provide repository security, tools enforce a variety of access schemes. Some rely on the operating system while others provide mechanisms independent of the operating system. Most tools allow the user to define varying levels of access for each project. Mechanisms are also implemented to provide protection from accidental or intentional data corruption and loss. Several tools provide backup, archive, and restore capabilities.

1.3.2.8 Reporting/Query

Most tools have the capability to generate standard reports and allow the user to develop customized reports. Typical SCM reports include:

- Dependency Report - identifies relationships between items
- Impact Report - identifies all components affected by a change
- Build Report - identifies all items that went into the build
- Change Status Report - identifies status of all changes
- Difference Report - identifies differences between versions of items

- History Report - summarizes the historical development of the product
- Access Control Report - lists access privileges for all users
- Conflict Detection Report - identifies conflicts created by parallel development.

Standard Query Language (SQL), or proprietary database query languages, are used to obtain database information. The query capability supports configuration audits and the collection of metrics. Typical queries answer questions such as: *What access rights do the testers have? How many items are complete? What problems are fixed in this release?* and *What is the status of version 2.1?*

1.3.2.9 Tool Integration

SCM tools may provide interfaces with documentation tools, compilers, software engineering environments, version control tools, defect/change tracking tools, build facilities, and CASE tools. One goal of an integrated environment is to establish traceability between all items that comprise a system. With the introduction of CASE, the traceability problem is complicated because there is an increased number of items that need to be traced. Many CASE tools prohibit SCM tools from accessing or controlling data. Several distinct approaches have been developed in an attempt to solve this problem. "These approaches include:

- Buy an Integrated Project Support Environment (IPSE) such as one based on the international standard, the Portable Common Tool Environment (PCTE)
- Buy a tool coalition set from CASE tool vendors where the vendors do all the source-code level integration
- Buy a meta-tool that enables customers to rapidly develop their own highly customized set of tools" [Dart 92].

Currently, most integration with SCM tools is performed by CASE tool vendors. Additional tool integration information can be found in *Issues and Techniques of CASE Integration with Configuration Management* by Kurt W. Wallnau.

In addition to integration with CASE tools, SCM tools may provide filters that load existing data from SCCS or other version control tools to the host repository. Several tools are integrated with Ada compilers.

1.3.2.10 Build Support

Software systems are comprised of many different items. Building these systems can be a long and complicated process. SCM tools need to track each item and information about each item that comprise the build. Several tools implement their own build facility while others interface with *Make*. Other tools have implemented smart building techniques that recompile only those items that have changed or have been affected by the changes. Advanced tools provide support for the following types of builds:

- Cross development builds - building on a remote or different target machine
- Parallel builds - running multiple build processes on one machine at the same time
- Distributed builds - running multiple builds on different machines at the same time.

1.3.2.11 Release Management

Files that are generated during the final build of a system are generally placed on tape or other media and delivered to the customer. Tools track release information identifying *who, what, when*, and *where*.

1.3.2.12 Customization Support

Recent advancement in SCM technology supports the customization of SCM tools. Customization can be done by the user or vendor by a variety of methods. Several tools provide a special language that allows the user to perform customization. Tools allow for the customization of user interfaces, reports, lifecycle models, user roles, security and access controls, identifying information, and file attributes as well as the process.

1.3.2.13 Graphical User Interfaces

State-of-the-art tools provide GUIs that have the capability to display the version history of the system, allow visual merging, and display on-line reports and forms. Older tools are currently being redesigned to support GUIs.

1.4 Concepts in Software Configuration Management Tools

SEI has conducted extensive research in SCM technology. While evaluating SCM tools in the marketplace, they discovered, as did others who have evaluated SCM tools, that there is no consistent SCM terminology. Different vendors call the same function by different names. Also, the functionality provided by SCM systems was not consistent, making the comparison and evaluation of SCM tools difficult. SEI has identified 15 concepts that enable people to discuss automated SCM support. These concepts, listed below, are explained in detail in *Concepts in Configuration Management Systems* by Susan Dart.

- Repository
- Distributed Component
- Context Management
- Contract

- Change Request
- Lifecycle Model
- Change Set
- System Modeling
- Subsystem
- Object Pool
- Attribution
- Consistency Maintenance
- Workspace
- Transparent View
- Transaction.

SEI also identified four SCM models that incorporate various combinations of the above concepts. The four models can be characterized as follows: "The *Check-out/Check-in model* offers version management of individual system components. The *composition model* focuses on improving the construction of system configurations through selection of alternative versions. The *long transaction model* emphasizes the evolution of systems as a series of configuration versions and the coordination of concurrent team activity. The *change set model* promotes a view of configuration management focused on logical changes" [Feiler 91]. The reader is encouraged to read Feiler's *Configuration Management Models In Commercial Environments* to develop a better understanding of the internal mechanisms of SCM tools.

1.5 Evaluation of SCM Tools

Before beginning an evaluation of SCM tools, the reader is encouraged to read SEI's *A Guide to Classification and Assessment of Software Engineering Tools*. This report provides a list of questions that one should consider when examining CM tools. The questions are grouped into the following areas:

- Ease of use - addresses features that make the tool easy to use (i.e., *Can the user interface be tailored?*)
- Power - addresses for instance, how one command can cause a major effect (i.e., globally replacing "Hal" with "Val")
- Robustness - addresses factors such as reliability, performance of the tool under failure conditions, and the consistency of tool operations (i.e., *What happens to the tool when the network crashes?*)
- Functionality - addresses what the tool is designed to do and the methods implemented to accomplish the tasks (i.e., implementation of the Checkin/Checkout model)
- Ease of insertion - addresses the ease in which the tool can be incorporated into the project environment (i.e., *Is installing the tool simple and straightforward?)*
- Quality of commercial support - addresses cost of maintenance agreements, types of training and vendor track record. The SCM product sheets, located in Appendix B, contain helpful vendor information.

In addition, an important issue that should be considered when evaluating SCM tools is scalability. Scalability should be addressed for each feature of the tool (i.e., *How many components can the tool track? What is the largest number that can be used when identifying the software hierarchy? What is the largest number of users? How many stages can be specified in the lifecycle model?*)

1.6 SCM Technology Listing

A list of SCM tools, sorted by product name, is contained in Appendix B.

1.7 Product Sheets

Appendix C contains product sheets for various SCM tools. The information contained in these sheets has been provided by the corresponding vendor in response to a questionnaire distributed by the STSC SCM Team. This information is more comprehensive than that provided in the tools list and contains specific details about the tool including: recommended configuration, pricing, vendor history, and tool description.

1.8 Product Critiques

Appendix D contains critiques of selected SCM tools provided by experienced users of the tools, whose names were provided by the vendors. These critiques include information about the operational environment, application, and notable strengths and weaknesses of the tool.

1.9 Software Configuration Management Standards

The Air Force has been a leader in recognizing the benefits of Configuration Management. The development of ballistic missiles and jet aircraft are examples of large, complex programs that require Configuration Management. The first standard, AFSCM 375-1, was issued in 1962 in response to control and communication problems encountered during the design of a jet aircraft. Additional Configuration Management standards were produced by industry and government agencies. The concepts in these early standards addressed hardware Configuration Management issues only. Both hardware and software standards have continually evolved over the years.

Presently, the major AF standard addressing SCM is MIL-STD-973, *Configuration Management.* MIL-STD-973 was written for both hardware and software Configuration Management, and addresses the four functions of Configuration Management as well as planning and data requirements. MIL-STD-973 consolidates

configuration mangement requirements which were previously scattered throughout several Configuration Management documents. In addition, MIL-HDBK-61, *Configuration Management*, was developed to provide guidance for implementing and tailoring MIL-STD-973.

The IEEE Computer Society has been active in the development of SCM standards. They have produced excellent SCM standards including IEEE-STD-1042, *Guide to Software Configuration Management* and IEEE-STD-828, *Software and Configuration Plans*. Appendix E contains a list of SCM standards. A more detailed discussion on emergence of configuration management standards and the history of SCM is found in *Software Configuration Management* by H. Ronald Berlack.

1.10 References and Recommended Readings

Appendix F includes references to texts and recommended readings that may provide insight to SCM theory, technology, and evaluation information.

1.11 Glossary

Appendix G provides a glossary to aid the reader in defining terms common to the SCM domain and used in this report.

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2 State of the Software Configuration Management Domain

2.1 Current Trends

Many organizations are struggling with SCM problems. As software becomes more complex and programming teams increase in size, organizations typically encounter the following SCM problems:

- The latest version of source code cannot be found
- Bugs that were fixed in a previous software version reappear again
- No one knows which modules comprise the software system delivered to the customer
- System builds take too long
- Programmers are working on the wrong version of the code
- The wrong version of the code was tested
- There is no traceability between the software requirements, documentation, and code.

Organizations have recognized the need for automated SCM support and have taken different approaches to solve their SCM problems. Many organizations have developed their own SCM tools, but soon discovered that the maintenance of the tools was as costly and difficult as the software they were designed to support. Other organizations use basic version control utilities along with manual procedures, but found the tools and procedures did not scale up to meet the needs of current software projects. Still others have purchased SCM tools and found that the tools alone did not solve all their SCM problems. Automated SCM solutions exist, but solving an organization's SCM problems requires addressing both technical and managerial issues. These issues are discussed in Section 3.1.

SCM tools have capabilities to coordinate the effort between teams of software developers working on distributed, heterogeneous platforms, supporting a combination of programming languages. SCM tools have emerged into total change management systems that manage all software work products throughout the software lifecycle.

SCM tools are continually evolving to satisfy the requirements of users. The demand for SCM technology is increasing. It is estimated that the revenues from SCM tools have grown by 50 percent in 1993 [Ingram, Burrows, Wesley 93]. Industry trends that have increased the demand for SCM tools include:

- The migration from mainframes to workstations and PCs
- Scale and complexity of applications
- Maintenance of legacy software systems
- Distributed development
- Parallel development
- Support for software reuse
- Support for process.

2.2 Future Directions of the SCM Domain

The future involves addressing other Software Engineering issues to help solve SCM problems. For example, the complexity of many SCM problems will be reduced as we learn more about software architectures. As advancements in software architectures are made, software systems will become more adaptable to change. Programmers will have the ability to easily make changes without severely impacting the software system.

Research conducted by Susan Dart identified five main SCM challenges to be addressed in the future. They include:

- Technological - this involves expanding SCM tool functionality and addressing tool integration issues
- Process-oriented - this involves developing a better understanding of SCM processes and providing more process automation
- Managerial - this involves management providing better support for SCM adoption
- Political - this involves government requiring contractors to provide SCM facilities in order to get a contract
- Standardization - this involves addressing software engineering environment and SCM standards [92 Dart].

SEI is beginning to address these issues through the development of a SCM service model. For further details see *The Past, Present & Future of Configuration Management,* by Susan Dart.

2.3 SCM and Ada

The Ada Language was designed for the type of projects that require extra attention when considering configuration management requirements. These projects are typically large, normally consist of a team of many programmers, and are frequently supported in a wide variety of configurations. As with any language, issues such as multiple platforms, distributed development, and concurrent development must be considered when developing a software configuration management approach. In addition, some features unique to the Ada programming language require special consideration in the planning and execution of a software configuration management environment. Three such features are the Ada *with* clause, the Ada program library, and Ada's stringent compilation requirements. The following paragraphs will discuss these features and examine their impact on software configuration management.

An Ada system is typically divided into a number of Computer Software Configuration Items (CSCIs). Each CSCI may be composed of one or more Ada units. The number of units that make up a CSCI is driven by the logical decomposition of the system. Typical Ada units are the package and the main procedure. An Ada package consists of a specification and a body, which are tracked as two separate files. The specification is the interface to the package and identifies any information accessible to a user of the package (visible). The body contains the implementation details of the package (not visible to user). An Ada *with* dependency indicates that a particular unit requires the resources of the named package, such as procedures or data definitions, and provides access to them. The software engineering concept of *information hiding* requires access to these resources be accomplished through the package interface, the specification. Thus, if changes are made to a package's body, the effects of the changes are isolated to that package. If changes are made to the specification (interface) of the package, the effects of the change will spread to all the other program units that *with* (depend on) that unit. For this reason, changes made to a package specification should be coordinated with the Software Configuration Control Board. Changes to the body are isolated from the rest of the system, maintaining form-fit-function.

Due to the extensive number of units which may *with* a particular package, and the resulting complexity of the compilation order created by the hierarchy of dependencies and Ada's stringent compilation requirements, it is imperative that emphasis be placed on software configuration management when using Ada. Changing one unit may proliferate throughout the entire system during recompilation if steps are not taken to minimize the impact. Smart recompilation is one method to minimize the impact created by the Ada *with* clause with respect to configuration management. Smart recompilation only compiles the units that are strictly necessary. Recompilation of a unit is not required for upward compatible changes, changes which do not affect a dependent unit, or the addition of or changes to the comments of a unit. Smart recompilation minimizes the impact of the Ada *with* clause with respect to software configuration management since if recompilation is not required then it is probably not appropriate for a program library to be preserved as a

version. Minor changes for which a new version is not necessary should, however, be tracked and incorporated into a new version at a later date when an update is required.

The second attribute of Ada which impacts SCM is the structure of an Ada library. Two goals of the Ada programming language are the concepts of modularity and reusability. Multiple access for system components, both internal to that system and externally by other systems, to Ada source code and libraries are provided to accommodate these goals. Multiple access to system components requires special consideration with regard to SCM since it is possible that simultaneous changes to a compilation unit may occur, or a change to a compilation unit in one library hierarchy may not be seen by a sharing library.

It is possible to minimize the impacts that the two features of Ada, the *with* clause and the Ada library structure, have on SCM by ensuring certain activities are carried out. As a minimum, a CM environment for Ada must ensure:

- Version Control [Whitgift 91]

  - *The program library exists as a set of identified versions.* Due to the stringent compilation requirements of Ada, not every compilation of an Ada unit should create a new version of the library. The software manager should determine when a program library should be saved as a version based on the amount of rework required to dependent units.

  - *The derivation of each version of the library is recorded.* When a new version of an Ada library is necessary, the derivation (compilation script) of each version must be recorded to provide for repeatability.

- Access Control

- *Mutually exclusive access must be provided to Ada program units.* Due to the high degree of access to Ada units allowed in the Ada library structure, write access to individual Ada units must be controlled by some type of check-out/check-in mechanism to prevent multiple simultaneous changes [Buckley, 92]. For example, files in the system library could be made read only to everyone except the software manager or a designated representative.

- *Access to Ada Program Libraries must be controlled.* Multiple level Ada program libraries should be created with a parent program library that has limited access and contains a stable version of the system being developed. Programmers can set up one or more program sublibraries where code may be modified, debugged, and tested in the context of the stable versions in the parent library. After the compilation units have been successfully changed, they can be moved to the parent library by someone with access authority such as the software manager.

Since it is not practical to discuss all of the details of the Ada programming language or all of the ramifications its use has on developing a configuration management approach in this document, it is recommended that the reader refer to the referenced literature for more detailed guidance.

3 Applications

3.1 Software Configuration Management Adoption

Software Configuration Management Adoption consists of all the steps involved in introducing a SCM tool into an organization, and ensuring that it is routinely used on all projects. SCM adoption is a complex process. It affects all levels of the organization; therefore, an in-depth evaluation of the organization is required to determine how the processes and people will be affected. SCM concepts are not difficult to understand, but are difficult to apply. The successful adoption of SCM technology becomes more of a cultural issue than a technical one.

Many organizations thought purchasing a SCM tool would solve their problems, but soon discovered that there was no "silver bullet" SCM tool. A tool alone will not solve an organization's SCM problems. Results of a study conducted by the Gartner Group determined that the cost of the software tool represents only 10 percent of the total cost of implementing a solution. Lost productivity accounts for 50 percent and the remaining 40 percent of the solution is derived from the cost of manpower [Softool 92]. Choosing the right tool to satisfy an organization's SCM requirements will in itself fail if other issues are not addressed. To ensure an effective SCM solution, an organization must address the complexities that it faces when implementing a change. "These complexities include:

- Technical - these issues relate to how the tool operates, how it will be installed to maximize performance and how it will be customized; e.g., how the tool will be installed over the company's network in the client-server architecture given the different platforms and how can it be used to suit the parallel development activities of the various teams.

- Managerial - these issues relate to the necessary planning, monitoring, setting of priorities, making of schedules, and resource management; e.g., who will be allocated to fulfill the adoption activities, how will the product schedules be affected, and which will cut over to the tool first?

- Process related - these issues relate to the way the company does its business; e.g., what is the current flow throughout the company and how do the developers, testers, QA personnel, build managers, document writers, etc. work together to ensure this flow?

- Organizational - these issues relate to the infrastructure in the company; e.g., how will the tool affect the responsibilities of each department and their intercommunication?

- Cultural - these issues relate to the way people operate and achieve their goals; e.g., what kind of culture exists at the company and what is the best way to invoke change in that culture?

- Political - these issues relate to "who is stepping on whose toes"; e.g., how will the organizational boundaries change, who will be responsible for what, and how will people be rewarded based on making the change?

- People-related - these issues relate to people's comfort level; e.g., how will resistance be managed and will anybody lose their job because of this tool?

- Risk-related - these issues relate to unknown information and tricky problems; e.g., how will the effect of making concurrent changes, such as to a new operating system to new hardware, as well as reengineering the legacy code, impact the new SCM system?" [Dart 94]

The greatest barrier to overcome when introducing SCM into an organization, is to change how people view SCM. People generally react negatively toward SCM. Many software developers perceive the tool as intrusive and have little understanding of the long-term effects of not following SCM procedures. In many organizations, SCM has a low status, and SCM personnel are not trained or qualified to perform SCM duties. The person in charge of SCM needs a broad understanding of software engineering principles and the cultural aspects of the organization. Training becomes an important aspect of ensuring that SCM principles are adopted by the organization.

The SCM adoption effort must be treated as a project with realistic goals and a defined schedule. SCM adoption is generally carried out in the phases listed below. Key activities may be carried out during several phases of the implementation. At all phases, it is important to reinforce management's commitment to the adoption effort and to provide training. The phases are as follows:

Phase 1: Preparation and Planning
Phase 2: Process Definition
Phase 3: Tool Evaluation
Phase 4: Pilot Project Implementation
Phase 5: Roll-out to Other Projects
Phase 6: Process Improvement Phase

3.1.1 Phase 1: Preparation and Planning

This is the stage most organizations fail to perform, thereby resulting in the unsuccessful adoption of SCM. The purpose of this phase is to plan for the adoption activities. An SCM Adoption Plan is created and members of the SCM adoption team are selected. Typical Adoption Plan information details the benefits of SCM, outlines

schedule and resources required, establishes roles of the adoption team, and contains all the procedures and policies involved in the adoption.

Next, the requirements are defined and prioritized. Developing a clear understanding of the organizations strategic goals is required to evaluate the SCM requirements. The evaluation of SCM requirements should not be conducted in a vacuum. All members of the organization who will be affected by SCM must be surveyed to identify their SCM requirements and to determine their roles in the SCM process. Careful attention must be paid to the training requirements of all people affected by the SCM tool.

In addition, all levels of management must be aware of the benefits of SCM. Many times this involves showing financial and scheduling benefits (i.e., increase in programmer productivity by automating SCM tasks). With the mandate for organizations to reach Level 3 Process Maturity, it is becoming easier to accomplish this task.

Next, an inventory of present hardware and software platforms is conducted and future hardware and software platforms identified.

The development of an SCM plan is also initiated during this phase. The plan identifies the following:

- SCM activities over the software lifecycle
- SCM organization
- SCM responsibilities and authority
- Resources needed to perform SCM functions
- Interfaces to other organizations
- SCM roles, policies, and procedures
- The change control process
- Level of SCM control
- Library requirements and activities

- Members of the Configuration Control Board.

The following is a list of technical reports and standards that provide assistance with activities of the Preparation and Planning Phase:

- IEEE STD-1042-1987, *Guide to Software Configuration Management*
  This guide provides detailed information on issues to consider when planning and implementing SCM.

- IEEE STD-828-1990, *Standard for Software Configuration Management Plans*
  This standard provides guidance in identifying which SCM activities are to be done, how they are to be done, who is responsible for doing specific activities, and what resources are required. The standard has several examples of SCM Plans that can be tailored to meet the requirements of most organizations.

- SEI's *Analysis of a Software Maintenance System: A Case Study*
  This case study presents an analysis of an organization's SCM process and provides a mapping of the organization's practices to the goals of the SCM.

3.1.2 Phase 2: Process Definition

A defined software change process is pertinent to the successful implementation of SCM. Without a defined process, the organization will make little progress in the adoption. A variety of methods exist for defining the process. STSC's *Software Process Technologies Method and Tool Report* summarizes process methodologies and provides a reference for a detailed study of process methodologies. Additional information on process can be obtained from SEI, IEEE, and the STARS project.

3.1.3 Phase 3: Tool Evaluation

This phase consists of matching the organization's requirements to SCM tools. Information found in this report, along with the references, provides a starting point for those responsible for selecting an SCM tool. It may take as long as six months to completely understand the functionality of an SCM tool.

3.1.4 Phase 4: Pilot Project Implementation

The purpose of this phase is to determine how well the SCM tool satisfies the organization's requirements. A pilot project allows testing of the tool's functionality on a real project with real data. In addition, the pilot allows for the prototyping of processes/procedures and provides feedback on how the users respond to the tool.

3.1.5 Phase 5: Roll-out to Other Projects

This phase involves incrementally migrating the tool into other projects. Training and dealing with resistance to change are key activities of this phase. This stage is complete when the SCM is routinely used on all projects.

3.1.6 Phase 6: Process Improvement

This phase involves evaluating current processes and procedures to determine which areas need to be improved.

More details on SCM adoption can be found in *Adopting An Automated Configuration Management Solution* by Susan Dart.

4 Case Studies

Case Studies are an important source of information for the software professional. They provide valuable information that details the lessons learned by other organizations. The Case Studies listed below describe how two organizations implemented SCM.

- Analysis of a Software Maintenance System: A Case Study by Howard M. Slomer and Alan M. Christie
  Reference: *SEI Technical Report CMU/SEI-92-TR-31.*

  Description: This report describes how software maintenance is performed within a project supported by the U.S. Department of Defense. The software environment, which is supported and maintained by the project, is designed to process large amounts of textual information and to retrieve information from dissimilar remote systems. It provides a set of UNIX tools that includes: a high-performance distributed editor, a database, a forms generator package, a mail system, application programs, and standard user interface. The project supports a mail system, application programs, and standard user interface. The project also supports a large collection of library modules (about 1,000) that are used both internally and by other software development organizations. The project maintenance system is now quite mature, supporting approximately 350,000 lines of code and having processed to date approximately 2,000 change requests. The report contrasts the configuration management practices of the project with those of the CMM.

- Managing Ada Using Rational's Configuration Management/Version Control and IBM's Software Configuration Management Library Manager by Deborah J. Blair
  Reference: *ACM 0-89791-529-1/92/0011-024 1.50.*

Description: This paper describes one solution for managing Ada software across multiple machines. The solution was used on the World Wide Military Command and Control System (WWMCCS) World Wide Information System Common User Contract (WWISCUC or WIS) project. A description of the project's CM process is presented. The report details how Rational's CM functionality together with IBM's Software Configuration Manager Library (SCML) satisfied the projects CM requirements.

APPENDIX A

CMM and STARS Project Overview

Capability Maturity Model
(CMM)

The Capability Maturity Model for software provides software organizations with guidance on how to gain control of their processes for developing and maintaining software and how to evolve toward a culture of software engineering and management excellence. The CMM was designed to guide software organizations in selecting process improvement strategies by determining current process maturity and identifying the few issues most critical to software quality and process improvement. By focusing on a limited set of activities and working aggressively to achieve them, an organization can steadily improve its organization-wide software process to enable continuous and lasting gains in software process capability.

Level	Characteristic	Improvement Focus
5 **Optimizing**	Continuous Improvement	Still human-intensive process Maintain organization at optimizing level
4 **Managed**	Measured process (quantitative basis for improvement)	Defect prevention Technology innovation Process change management
3 **Defined**	Process defined and institutionalized (qualitative basis for improvement)	Process measurement Process analysis Quantitative quality plans
2 **Repeatable**	Process still dependent on individuals (intuitive)	Organization process focus Organization process definition Peer reviews Training program Intergroup coordination Software product engineering Integrated software management
1 **Initial**	Crisis-driven (ad hoc/chaotic)	Software project planning Software project tracking Software subcontract management Software quality assurance Software configuration management Requirements management

The figure above describes the five levels of the CMM, the characteristics at each level, and the key process areas for each level (i.e., improvement focus areas).

For further information regarding the CMM and its associated products, including training on the CMM and how to perform software process assessments and software capability evaluations, contact:

SEI Customer Relations
Software Engineering Institute
Carnegie Mellon University
Pittsburgh PA 15213-3890
(412) 268-5800
Internet: customer-relations@sei.cmu.edu

SEI technical reports, such as the "Key Practices of the Capability Maturity Model, Version 1.1," is directly available from the Defense Technical Information Center (DTIC), the National Technical Information Service (NTIS), and Research Access Inc. (RAI). These documents can be obtained by contacting:

RAI: **Research Access Inc.**
3400 Forbes Avenue
Suite 302
Pittsburgh PA 15213
Telephone: (800) 685-6510
FAX: (412) 682-6530

NTIS: **National Technical Information Service**
U.S. Department of Commerce
Springfield VA 22161-2103
Telephone: (703) 487-4600

DTIC: **Defense Technical Information Center**
ATTN: FDRA Cameron Station
Alexandria VA 22304-6145
Telephone: (703) 274-7633

SEI technical reports are also available via Internet. To use anonymous ftp from a Unix system on Internet, enter the following:

ftp ftp.sei.cmu.edu

***login*: anonymous**
***password*: <your user id or any string>**
cd pub/cmm
get READ.ME
get <files>
quit

Note: The SEI ftp machine address is 128.237.2.179.

The file READ.ME contains information on what files are available. Other SEI publications are available in a similar manner.

The SEI WEB server, which will provide information on configuration management, will soon be available from SEI. The Universal Resource Locator (URL) for the CM material is: http://www.sei.cmu.edu/tech/cmHomePage.html.

Software Technology for Adaptable Reliable Systems (STARS) Program

STARS is a program of the Defense Advanced Research Projects Agency (DARPA). One of the goals of the STARS program is to promote and facilitate megaprogramming. Megaprogramming is an approach to modular software development and support that emphasizes the reuse of large segments of software. The STARS program works with the Software Engineering Institute (SEI), the Corporate Information Management (CIM) Program, standards organizations, and other groups to evolve open architecture standards and practices to support megaprogramming.

Organized under DARPA's STARS program is the ASSET Source for Software Engineering Technology, ASSET, which is a United States Department of Defense project to promote the reuse of computer software and software-related products.

ASSET's goals are to provide a national emporium for reusable software products, create a focal point for software reuse information exchange, advance the technology of software reuse processes, and stimulate a national software reuse industry.

ASSET services include distribution of reusable software products, telephone support for customers using the library components, solicitation or location of requested software assets, education and training in software reuse processes, assistance in establishing satellite reuse libraries, dissemination of the latest information in software reuse technology, maintenance of an electronic message board for exchange of reuse information, sponsorship of workshops and seminars on reuse topics, and the collection and classification of publications regarding software reuse technology.

For more information, contact:

STARS Technology Center
Suite 400
801 North Randolph Street
Arlington VA 22203
Telephone: (703) 243-8655
Fax: (703) 528-2627

or

ASSET
2611 Cranberry Square
Morgantown WV 26505
Telephone: (304) 594-1762
Fax: (304) 594-3951
Internet: librarian@source.asset.com

APPENDIX B

Products List

Product Name	Platform	Operating System	Vendor
ADC	APOLLO, APPLE, VAX, HP, SUN, PC	DOMAIN, A/UX, VMS, HPUX, SunOS, UNIX	Software Maint & Develop Sys, Inc. 508-369-7398
Adele	SUN, HP	SunOS, ULTRIX, UNIX	Verilog, Inc. 714-252-9096
AGE	SUN, HP	SunOS, ULTRIX, UNIX	Verilog, Inc. 714-252-9096
Analyzer	AS/400	OS/400	Aldon Computer Group 800-825-5858
Application Development Workbench	IBM	OS/2	KnowledgeWare, Inc. 206-646-4850
ARPUS/transCASE	APOLLO	DOMAIN	Enabling Technologies Group, Inc. 603-882-6400
Automated Systems Information Management	IBM Mainframe	MVS	Information Retrieval Companies, Inc. 800-IRC-7763
Bachman/ Production DBA	PC	OS/2	Bachman Information Systems, Inc. 617-273-9003
Bachman/ Analyst	PC	OS/2	Bachman Information Systems, Inc. 617-273-9003
CA-Librarian	IBM Mainframe	MVS/370, MVS/XA, MVS/ESA, VM	Computer Associates Int'l, Inc. 703-709-4767
CA-NETMAN	IBM Mainframe, VAX	MVS, VSE, VMS	Computer Associates Int'l, Inc. 703-709-4767
CA-PANAPT	IBM Mainframe	MVS/SP, MVS/XA, MVS/ESA	Computer Associates Int'l, Inc. 703-709-4767
CA-PAN/LCM	PC, HP, SUN	OS/2, HPUX, WINDOWS, SunOS	Computer Associates Int'l, Inc. 703-709-4767
CA-PAN/MERGE	IBM Mainframe	MVS	Computer Associates Int'l, Inc. 703-709-4767
CaseMate	CSC 7000/RTU, AT&T	UNIX	Concurrent Computer Corp. 800-631-2154

Product Name	Platform	Operating System	Vendor
CaseWare/CM	HP, SUN, RS6000, DEC, DG Aviion	HPUX, SunOS, AIX, ULTRIX, DGUX	CaseWare, Inc. 714-453-2200
CaseWare/PT	HP, SUN, RS6000, DEC, DG Aviion	HPUX, SunOS, AIX, ULTRIX, DGUX	CaseWare, Inc. 714-453-2200
Cat II	HP, SUN, DEC, RS6000	HPUX, SunOS, ULTRIX, AIX	Robbins-Gioia, Inc. 703-548-7006
CCC/Harvest	IBM, VAX, PC	MVS, VMS, MS-DOS, UNIX	Softool Corp. 703-847-6757
CCC/Manager	PC	MS-DOS, OS/2, WINDOWS	Softool Corp. 703-847-6757
CDD/ REPOSITORY	VAX, DECstation	VMS, ULTRIX	Digital Equipment Corp. 800-344-4825; 603-884-5111
Change Action	IBM Mainframe	MVS-GSA, MVS-XA	Action Software International 905-470-7113
CHANGEMAN	IBM, PC	MVS, OS/2, WINDOWS	Optima Software 916-646-3800
Change Manager for DB2	IBM Mainframe	MVS	BMC Software, Inc. 800-841-2031
ChangeVision for Softbench	SUN, HP	SunOS, HPUX	Hewlett-Packard Company 800-637-7740
ClearCase	HP, SUN, SGI	HPUX, SOLARIS, SunOS, IRIX	Atria Software, Inc. 508-650-1193
CMS	AS/400	OS/400	Aldon Computer Group 800-825-5858
CMS/MMS (see VAX DEC MMS)	VAX	VMS	Digital Equipment Corp. 800-344-4825; 603-884-5111
CMVision	HP, SUN, VAX	HPUX, SunOS, VMS, UNIX	EXPERTWARE, Inc. 510-867-0315
CMVC	RS6000, SUN, HP	AIX, SunOS, HPUX	IBM Corp. 213-621-5605
Comparex	PC, IBM Mainframe	MS-DOS, MVS, VSE	Sterling Software Sys Software Group 818-718-8877
CONTROL	SERVER: TANDEM CLIENT: PC	SERVER: GUARDIAN CLIENT: WINDOWS	Network Concepts, Inc. 201-285-0202
Data Dictionary Solution	IBM	MVS	BrownStone Solutions, Inc. 212-370-7160

Product Name	Platform	Operating System	Vendor
DDTs	SUN, RS6000, HP, DEC, PC	SunOS, SOLARIS, AIX, HPUX, ULTRIX	QualTrak Corp. 408-748-9500
DEC FUSE	VAX, DECstation, SUN	VMS, ULTRIX, SunOS	Digital Equipment Corp. 800-344-4825; 603-884-5111
Delta	PC	WINDOWS	Microsoft 800-421-8006, ext. 1436
DMS Pro	PC	MS-DOS, OS/2	Van der Roest Group, Inc. 714-542-2201
DOSSIER PROVE	IBM	VSE, VM	SystemWare Laboratories, Inc. 503-297-3567
Endevor	IBM Mainframe, PC	MVS, MS-DOS, OS/2, WINDOWS	Legent Corp. 800-726-1637
Envy/Developer	SUN, HP, PC, RS6000	OS/2, SunOS, MS-DOS, AIX, HPUX	Object Technology Int'l, Inc. 613-820-1200
Foundation	IBM Mainframe, PC, DECstation, HP	CICS, OS/2, Ultrix, HPUX	Andersen Consulting Marketing Oprtns 800-458-8851
Harmonizer Plus	AS/400	OS/400	Aldon Computer Group 800-825-5858
Historian Plus	HP, VAX, RS6000, SUN, SGI	HPUX, VMS, AIX, SunOS, IRIX	OpCode, Inc. 512-346-7090
Information Asset Management	SUN, HP, DEC, RS6000, SGI	SunOS, SOLARIS, HPUX, ULTRIX, UNIX	Atherton Technology 510-494-8411
IEF	SUN, HP, RS6000, IBM Mainframe	SOLARIS, HPUX, AIX, MVS	Texas Instruments, Inc. 913-451-4511
Info/Master	VAX	VMS	Systems Center, Inc. 703-264-8018
ISPW	IBM Mainframe	MVS/XA, MVS/ESA	BenchMark Technologies, Ltd. 403-269-7499
Keys	PC, IBM Mainframe	MVS, VSE, CICS, MS-DOS	Software Engineering of America 516-328-7000
Logiscope	SUN, HP, DECstation, VAX	SunOS, HPUX, ULTRIX, VMS	Verilog, Inc. 714-252-9096
Maestro II	IBM Mainframe, VAX, RS6000, HP	MVS, VMS, AIX, AIX, ULTRIX	Softlab, Inc. 404-668-8811

Product Name	Platform	Operating System	Vendor
MAKE	VAX, IBM, PC	MVS, MS-DOS, VMS	TauMetric Corp. 800-874-8501;619-697-7607
Merge/IT	IBM, VAX, HP, SUN	MVS, VMS, ULTRIX, UNIX	Softool Corp. 703-847-6757
Method Manager	PC, IBM	MVS, VM	Manager Software Products, Inc. 617-863-5800
MKS RCS	PC	MS-DOS, OS/2, WINDOWS, UNIX	Mortice Kern Systems, Inc. 800-265-4369
Net/Master	IBM	VM	Systems Center, Inc. 703-264-8018
Object CM	SUN, HP, RS6000	SunOS, HP/UX, AIX	Alsys, Inc. 619-457-2700
OpusMake	PC	MS-DOS, OS/2, UNIX	OPUS Software, Inc. 415-664-7901
PCMS	VAX, SUN, HP	VMS, SunOS, HPUX	SQL Software, Inc. 703-760-7895
PNMS	IBM Mainframe, HP, SUN, PC, RS6000	MVS, VM, HPUX, SunOS, MS-DOS, AIX	Peregrine Systems, Inc. 619-431-2400
PVCS	IBM, HP, SUN, VAX	MS-DOS, OS/2, VMS, SunOS, UNIX	Intersolv, Inc. 800-547-7827
Rational Rose	RS6000, SUN, PC	AIX, SunOS, Windows	Rational 800-767-3237
Resolve/IT	IBM Mainframe	MVS	Softool Corp. 703-847-6757
RTM	SUN, RS6000, HP,VAX	SunOS, SOLARIS, AIX, HPUX, VMS	Marconi Systems Technology 703-263-1260
Reuse Management	SUN, HP, DEC, RS6000, SGI	SunOS, SOLARIS, HPUX, ULTRIX, UNIX	Atherton Technology 510-494-8411
Sablime	AT&T, BULL, VAX, HP, SUN	UNIX	AT&T Software Solutions 800-462-8146
SBCS	AT&T, BULL, HP, SUN	ULTRIX, UNIX	AT&T Bell Laboratories 800-462-8146
SCLM	IBM, SUN, HP	SunOS, MVS, UNIX	IBM Corp. 800-333-6705
SCONS/3000	HP 3000	RTE-A, MPE-V, MPE-XL	Corporate Computer Systems 908-946-3800

Product Name	Platform	Operating System	Vendor
SMARTsystem	SUN, RS6000, HP	SunOS, AIX, HPUX	PROCASE Corp. 408-433-9500
Softboard	VAX	ULTRIX, VMS, UNIX	Atherton Technology 510-494-8411
Software Backplane	VAX, RS6000, SUN, DECstation	VMS, AIX, SunOS, ULTRIX	Atherton Technology 510-494-8411
Sourcebank	IBM Mainframe	VM/SP, VM/XA, VM/ESA	BlueLine Software, Inc. 800-826-0313
SourceCode Manager	SUN, AT&T, HP, RS6000	SunOS, UNIX, HPUX, AIX	The Software Foundry, Inc. 201-635-5528
Source Manager	PC, SUN	MS-DOS, UNIX	TransWare Enterprises, Inc. 408-227-7700
Source Recovery	IBM	MVS, VM, VSE	The Source Recovery Co., Inc. 404-785-9801
SourceTools	VAX, PC, IBM	MVS, MS-DOS, VMS	TauMetric Corp. 800-874-8501; 619-697-7607
SPARCworks/TeamWare	SOLARIS, SUN	SunOS, SOLARIS	SunPro 800-873-7869
SuperCase CMS	VAX	VMS, ULTRIX, UNIX	Advance Technology International 212-947-0086
Synchrony	PC, SUN	MVS, MS-DOS, OS/2	Telepartner International 800-935-3270; 203-674-2640
TeamMake	HP, SUN	SunOS	TeamOne Systems, Inc. 800-442-6650
TeamNet	HP, SUN	SunOS, HPUX	TeamOne Systems, Inc. 800-442-6650
TeamView	HP, SUN	SunOS, HPUX	TeamOne Systems, Inc. 800-442-6650
Telon	VAX, SUN, IBM, PC	MVS, VSE, VM, OS/2	Computer Associates Int'l, Inc. 703-709-4767
TLIB	PC	MS-DOS, OS/2 WINDOWS	Burton Systems Software 919-233-8128
VadsPro	SUN, DECstation, RS6000	SunOS, ULTRIX, AIX	Verdix Corp. 703-318-5800
VAX DEC CMS	VAX	VMS	Digital Equipment Corp. 800-344-4825; 603-884-5111
VAX DEC MMS	VAX	VMS	Digital Equipment Corp. 800-344-4825; 603-884-5111

Product Name	Platform	Operating System	Vendor
Version Merger	IBM	MVS	Princeton SOFTECH, Inc. 609-497-0205

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APPENDIX C

Product Sheets

ADC

Product Information:

Version Number:	9.0
Date of Last Release:	Mar 93
Date of First Release:	1983
Frequency of Updates:	1-2 times/yr.
Number Sold:	2,500 +

Vendor: Software Maintenance & Development Systems, Inc.

In Business Since:	1981
Address:	200 Baker Avenue Suite 300 Concord, MA 01742
Marketing Contact:	Bob Sanzo
Phone Number:	508-369-7398
Fax Number:	508-369-8272
E-mail Address:	adc@smds.com
Bulletin Board System:	
Customer Support:	508-369-7398
Fax - 508-369-8272	E-mail - adc@smds.com
Training Provided:	Yes
Consulting Support:	Yes
Customization:	Yes
By Vendor:	Yes
By User:	Yes

Pricing:

Single User Price:	See below
Site License:	Negotiable
Multicopy Price:	Base price of $19,500/8 users
GSA Price:	N/A
Maint. Price:	17%/year

Platform(s)/Operating System(s):
386/486 SCO Unix, DOS (client); DEC Alpha OSF/1 and VMS; DEC RISC OSF/1; DEC VAX VMS; HP 9000/400, 700, 800 series HPUX; IBM RS6000 AIX; MIPS BSD; Motorola 88000 SVR3; Pyramid S series; Sequent DYNIX; Silicon Graphics IRIX; Sun SPARC SunOS, Solaris; Unisys U6000 3x/6x, 7x/8x SvR4.

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)
ADC with the X/Motif GUI requires about 15 MB of disk storage for the system executables. Each Model 209 database requires 0.5 MB prior to loading of your software. A rule of thumb for database size is that a product will require 1.5 to 2 times its size on the file system after 2-3 years of active development.

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)
ADC is fully integrated with HP's SoftBench (specialized level), and with QualTrack's DDTs problem tracking system. ADC's scripting language can be linked with C.

Description/Purpose: (Identify support for Ada, 2167A)
Aide-de-Camp uses a database and change set technology to capture changes to your files. ADS includes Model 209, a pre-defined configuration process, and a command language that can modify this model or be used to define your own process. The files stored in the database can be text or binary files. A change set can store the changes made to many files (not just a single file delta), as well as information about the change, when, and why; source code dependencies, and attributes (tags or labels). The change set is a logical change that corresponds with a bug fix or product enhancement. A version in ADC is a collection of changes sets. Changes sets make it easy to create parallel development paths, to move a change from one path to another, and to merge code from two distinct versions. ADC does not have to apply deltas in sequence to arrive at a specific version of a file; the change sets applied in a given version determine the view of the file. Only users defined in the database have access to that database, and further restrictions are possible. ADC provides an optional Ada source code scanner. Model 209 can be extended to provide 2167A support.

ALDON ANALYZER

Product Information:

Version Number:	2.0D
Last Released:	Apr 1992
First Released:	Jun 1989
Freq. of Updates:	4-releases
Number Sold:	60 in 1993

Pricing:

Single User Price:	$3,800 to $5,700
Site License:	Negotiable
Multicopy Price:	Negotiable
GSA Price:	N/A
Maint. Price:	15 percent of list price.

Vendor: Aldon Computer Group

In Business Since:	1980
Address:	401 15th Street Oakland, CA 94612
Marketing Contact:	Ruth Stephens
Phone Number:	800-825-5858
Fax Number:	510-839-2894
E-mail Address:	N/A
Bulletin Board System:	N/A
Customer Support:	800-825-5858
Training Provided:	Yes
Consulting Support:	Yes
Customization:	No
By Vendor:	No
By User:	No

Platform(s)/Operating System(s):
IBM AS/400 - IBM OS/400.

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)
All Models IBM AS/400.
V2R2 Operating System.
15 MB Disk Storage.

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)
ADM.

Description/Purpose: (Identify support for Ada, 2167A)
Aldon Analyzer is a quality assurance and testing tool. Analyzer identifies which lines of code have been executed during testing, and which lines were missed. Analyzer ensures the users that their programs are comprehensively tested before moving them to production. Aldon/CMS and Harmonizer Plus are complementary products.

ALDON HARMONIZER PLUS

Product Information:

Version Number:	2.2
Last Released:	Jan 1994
First Released:	Jun 1990
Freq. of Updates:	Annually
Number Sold:	290 in 1993

Pricing:

Single User Price:	$4,500-$7,500
Site License:	Negotiable.
Multicopy Price:	Site discount.
GSA Price:	N/A
Maint. Price:	15 percent of list price.

Vendor: Aldon Computer Group

In Business Since:	1980
Address:	401 15th Street Oakland, CA 94612
Marketing Contact:	Ruth Stephens
Phone Number:	800-825-5858
Fax Number:	510-839-2894
E-mail Address:	N/A
Bulletin Board System:	N/A
Customer Support:	800-825-5858
Training Provided:	Yes
Consulting Support:	Yes
Customization:	No
By Vendor:	No
By User:	No

Platform(s)/Operating System(s):
IBM AS/400 - IBM OS/400.

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)
All Models IBM AS/400.
V2R2 Operating System.
25 MB Disk Storage.

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)
Pathfinder.
Abstract Probe.

Description/Purpose: (Identify support for Ada, 2167A)
Harmonizer Plus is a source compare and integration tool that identifies differences in source code that has been changed, added, or deleted, whenever a program is moved from the test library into production. Harmonizer Plus also verifies accuracy of output produced as a result of changes made to programs. Harmonizer Plus saves 60 to 80 percent of the time you spend merging customized versions of upgrades. Aldon/CMS and Analyzer are complementary products.

ALDON/CMS CHANGE MANAGEMENT SOFTWARE

Product Information:

Version Number:	4.1D
Last Released:	Jan 1994
First Released:	Mar 1991
Freq. of Updates:	Annually
Number Sold:	250 in 1993

Pricing:

Single User Price:	$5,000-$15,000
Site License:	Negotiable
Multicopy Price:	Site discount
GSA Price:	N/A
Maint. Price:	15 percent of list price.

Vendor: Aldon Computer Group

In Business Since:	1980
Address:	401 15th Street Oakland, CA 94612
Marketing Contact:	Ruth Stephens
Phone Number:	800-825-5858
Fax Number:	510-839-2894
E-mail Address:	N/A
Bulletin Board System:	N/A
Customer Support:	800-825-5858
Training Provided:	Yes
Consulting Support:	Yes
Customization:	No
By Vendor:	No
By User:	No

Platform(s)/Operating System(s):
IBM AS/400 - IBM OS/400.

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)
All Models IBM as/400.
V2R2 Operating System.
100 MB Disk Storage and user files.

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)
COGNOS - Powerhouse.
LANSA.
ASSET and Synon - future release.

Description/Purpose: (Identify support for Ada, 2167A)
Aldon/CMS Change Management System is an integrated system providing management control of the entire software development and maintenance process, including project tracking, object distribution, help desk information, and text data manager. The key feature is parallel development with emergency checkout available. Harmonizer Plus and Analyzer are add-on programming tools.

ARPUS/transcase

Product Information:

Version Number:	1.1
Last Released:	Sep 1993
First Released:	Mar 1993
Freq. of Updates:	Once
Number Sold:	Reference sites available upon request

Pricing:

Single User Price:	Contact vendor.
Site License:	Contact vendor.
Multicopy Price:	
GSA Price:	
Maint. Price:	Contact vendor.

Vendor: Enabling Technologies Group, Inc.

In Business Since:	1990
Address:	Five Spruce Park Amherst, NH 03031
Marketing Contact:	Robert H. Wilson
Phone Number:	603-882-6400
Fax Number:	603 673-0363
E-mail Address:	75736.2323@compuserve.com
Bulletin Board System:	No
Customer Support:	Yes
Training Provided:	Yes
Consulting Support:	Yes
Customization:	Yes
By Vendor:	Yes
By User:	Yes

Platform(s)/Operating System(s):
Apollo Domain/OS system running version system release 10.3.5 or higher.

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)
Any Apollo supporting DSEE.

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)
TRANSCASE is a member of the ARPUS Software Product Family (TransCase, transScript, transSource), a set of tools and utilities that enhance productivity of individuals and work groups using workstations and personal computers.

Description/Purpose: (Identify support for Ada, 2167A)
TRANSCASE is a tool that extracts DSEE elements, along with important change history, version number, and configuration information and exports them in SCCS format for easy import into many Unix case systems.

BACHMAN/ANALYST

Product Information:

Version Number:	4.15
Last Released:	Jun 1993
First Released:	Jan 1991
Freq. of Updates:	Bi-annual
Number Sold:	4,000

Pricing:

Single User Price:	$10,000
Site License:	N/A
Multicopy Price:	Volume discount.
GSA Price:	$6,000
Maint. Price:	$1,500

Vendor: Bachman Information Systems, Incorporated

In Business Since:	1983
Address:	8 New England Executive Park Burlington, MA 01803
Marketing Contact:	Dave MacKenzie
Phone Number:	617-273-9003
Fax Number:	617-229-9904
E-mail Address:	N/A
Bulletin Board System:	N/A
Customer Support:	617-273-9003
Training Provided:	Yes
Consulting Support:	Yes
Customization:	Yes
By Vendor:	No
By User:	No

Platform(s)/Operating System(s):
OS/2 V1.3 or higher.

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)
Intel 80386 or 80486 based PC.
12 MB memory.
2 button mouse.
115 MB hard drive.
VGA color or monochrome monitor.

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)
The Bachman/Analyst is able to import information from both KnowledgeWare's ADW and Intersolv's Excelerator. The Analyst can also work with the leading repositories and data dictionaries such as Brownstone, Deltech, DOCaid, and Infospan.

Description/Purpose: (Identify support for Ada, 2167A)
The Bachman/Analyst is a comprehensive, graphical, and integrated environment for creating enterprise models. The Bachman/Analyst provides a comprehensive picture of the business through an enterprise model that unifies and synchronizes the data, process, and logic models. These models can then be forward-engineered to a wide variety of databases and code generators.

BACHMAN/DBA

Product Information:

Version Number:	4.15
Last Released:	Jun 1993
First Released:	Jan 1989
Freq. of Updates:	Bi-annual
Number Sold:	1,000

Pricing:

Single User Price:	$15,000
Site License:	N/A
Multicopy Price:	Volume discount.
GSA Price:	$9,000
Maint. Price:	$2,250

Vendor: Bachman Information Systems, Incorporated

In Business Since:	1983
Address:	8 New England Executive Park Burlington, MA 01803
Marketing Contact:	Dave MacKenzie
Phone Number:	617-273-9003
Fax Number:	617-229-9904
E-mail Address:	N/A
Bulletin Board System:	N/A
Customer Support:	617-273-9003
Training Provided:	Yes
Consulting Support:	Yes
Customization:	No
By Vendor:	No
By User:	No

Platform(s)/Operating System(s):
OS/2 V1.3 or higher.

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)
Intel 80386 or 80486 based PC.
12 MB memory.
2 button mouse.
115 MB hard drive.
VGA color or monochrome monitor.

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)
Works with BMC's Change Manager and links to a variety of RDBM's, i.e., DB2, SQL/Server, Oracle, RDB, ADABASE, DB2/2, Ingres, and Informix.

Description/Purpose: (Identify support for Ada, 2167A)
The Bachman/DBA tool takes information from the models developed in the Bachman/Analyst. The models are forward-engineered into relational designs where the built-in expert systems ensure a quality design. This is then forwarded to the appropriate database of choice.

BACHMAN/PRODUCTION DBA

Product Information:

Version Number:	4.15
Last Released:	
First Released:	
Freq. of Updates:	Bi-annual
Number Sold:	50

Pricing:

Single User Price:	$20,000
Site License:	
Multicopy Price:	Sliding scale.
GSA Price:	$12,000
Maint. Price:	$3,000

Vendor: Bachman Information Systems, Incorporated

In Business Since:	1983
Address:	8 New England Executive Park
	Burlington, MA 01803
Marketing Contact:	Dave MacKenzie
Phone Number:	617-273-9003
Fax Number:	617-229-9904
E-mail Address:	N/A
Bulletin Board System:	N/A
Customer Support:	617-273-9003
Training Provided:	Yes
Consulting Support:	Yes
Customization:	Yes
By Vendor:	Yes
By User:	No

Platform(s)/Operating System(s):
OS/2 V1.3 or higher.

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)
Intel 80386 or 80486 based PC.
12 MB memory.
2 button mouse.
115 MB hard drive.
VGA color or monochrome monitor.

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)
Works in conjunction with Bachman's CASE tool, the Bachman/Analyst, and BMC's Change Manager, as well as IBM's DB2 catalog.

Description/Purpose: (Identify support for Ada, 2167A)
The Bachman/Production DBA is a workstation-based tool that, when used in conjunction with BMC's Change Manager, enables you to manage change throughout the entire DB2 application development lifecycle.

CA-LIBRARIAN

Product Information:

Version Number:	R3.9
Last Released:	
First Released:	1969
Freq. of Updates:	Every 1-2 years
Number Sold:	N/A

Pricing:

Single CPU Price:	$11,000 to $150,000
Site License:	N/A
Multicopy Price:	$7,200-$98,000
GSA Price:	Single CPU price.
Maint. Price:	$2,200-$37,000

Vendor: Computer Associates International

In Business Since:	1976
Address:	12120 Sunset Hills Road Reston, VA 22090
Marketing Contact:	Stuart Fleagle
Phone Number:	703-709-4767
Fax Number:	703-709-4820
E-mail Address:	N/A
Bulletin Board System:	N/A
Customer Support:	908-874-9610
Training Provided:	Yes
Consulting Support:	Yes
Customization:	Yes
By Vendor:	Yes
By User:	Yes

Platform(s)/Operating System(s):
CA-Librarian runs on any IBM system/370, 30XX, 43XX, or true compatible processor running under a supported release of the following operating systems: MVS/370, MVS/XA, MVS/ESA, VM.

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)
DASD: Approximately 800 tracks minimum is required for CA-Librarian. Additional space is required as needed to accommodate user programs and master files.

User Interface: Librarian can be accessed on-line via 3270 terminal or executed through the batch facility.

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)

CA-ACF2	CA-Topsecret
IBM/RACF	CA-ROSCOE
CA-Vollie IBM/TSO	
CA-Datadictionary	CA-7
CA-Earl	CA-Scheduler
CA-Netman	CA-PAN/LCM (PC)

Description/Purpose: (Identify support for Ada, 2167A)
The CA-Librarian is a complete and flexible storage and archiving facility. Program source statements, JCL, procedures, or any 80-byte record can be stored.

The archiving facility allows members to be recreated to any prior version or date and time. CA-Librarian has its own compression facility to effectively use disk space. In addition, CA-Librarian has a comparator facility to compare two members and produce an update check if needed. CA-Librarian has a complete change management facility to track program changes from test through production environments. It allows for complete control of changes with change approval or rejection at any point in its process.

CA-PAN/LCM

Product Information:

Version Number:	R3.3
Last Released:	1991
First Released:	1989
Freq. of Updates:	6 Mo. - 1 Yr.
Number Sold:	N/A

Vendor: Computer Associates International

In Business Since:	1976
Address:	12120 Sunset Hills Road
	Reston, VA 22090
Marketing Contact:	Stuart Fleagle
Phone Number:	703-709-4767
Fax Number:	703-709-4820
E-mail Address:	
Bulletin Board System:	
Customer Support:	708 505-6782
Training Provided:	Yes
Consulting Support:	Yes
Customization:	Yes
By Vendor:	Yes
By User:	Yes

Pricing:

Single User Price:	$325
Site License:	$48,750 - $97,500
Multicopy Price:	$325
GSA Price:	$325
Maint. Price:	$65

Platform(s)/Operating System(s):

IBM PC/XT/AT or PS2 compatible workstation.
Microsoft Windows 3.1 or higher.
IBM OS/2 1.0 or higher.
AIX UNIX 3.2 or higher.
HP-UX Unix 8.0.2 or higher.
Sun OS Unix 5.1 or higher.
MS-DOS or PC-DOS 3.3 or higher.
SCO ODT Unix 1.1 or higher.

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)

Need to consolidate info for this box.

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)

CA-PANVALET
CA-LIBRARIAN
CA-REALIA II Workbench

Description/Purpose: (Identify support for Ada, 2167A)

CA-PAN/LCM provides change and configuration management for PC/Workstation and PC/LAN environments. CA-PAN/LCM maintains a history of all programming changes. Supports concurrent development through automatic branching and extensive merge facility. Impact analysis, automated builds, and cross-project dependency tracking handled in automated manner. Environments migrating application development from mainframe to LAN or PWS platform benefit from CA-PAN/LCM host library Integration facilities. Full mainframe-based control, accountability, and established promotion procedures are available across platforms through use of this interface. All features are accessible from GUI. MS/DOS menu-driven facility and/or command line interface is also available.

CA-PAN/MERGE

Product Information:

Version Number:	R1.0
Last Released:	1990
First Released:	1990
Freq. of Updates:	Every 1-2 years
Number Sold:	N/A

Pricing:

Single CPU Price:	$4,915-$20,000
Site License:	N/A
Multicopy Price:	$3,200-$13,000
GSA Price:	Single CPU price.
Maint. Price:	$1,200-$5,000

Vendor: Computer Associates International

In Business Since:	1976
Address:	12120 Sunset Hills Road Reston, VA 22090
Marketing Contact:	Stuart Fleagle
Phone Number:	703-709-4767
Fax Number:	703-709-4820
E-mail Address:	
Bulletin Board System:	
Customer Support:	708 505-6784
Training Provided:	Yes
Consulting Support:	Yes
Customization:	Yes
By Vendor:	Yes
By User:	Yes

Platform(s)/Operating System(s):
IBM Mainframe/MVS.

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)
TSO/ISPF 2.1 or higher.

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)
CA-PAN/APT
CA-PANVALET

Description/Purpose: (Identify support for Ada, 2167A)
CA-PAN/MERGE is a development tool that allows users to easily combine separate sets of program changes into one program. Concurrent development and maintenance of vendor software often results in separate sets of changes to the same programs. Manual Integration of these changes can be tedious, error-prone, and time consuming. CA-PAN/MERGE automatically identifies all change overlays, and conflicting changes are clearly marked. Problems can be resolved on-line or deferred until later. Detail reports show the changes made to each input file, while the summary reports provide the total number of inserted, deleted and moved records, and total number of conflicts.
Integration between CA-PANVALET and CA-PAN/MERGE currently enables the merging of any combination of CA-PANVALET, PDS, or sequential files. Multiple file types can easily be compared and combined to detect potential conflicts, increasing programmer productivity and application quality and reliability.

CA-PANAPT

Product Information:

Version Number:	R.1.3
Last Released:	1993
First Released:	1988
Freq. of Updates:	1 to 2 years
Number Sold:	N/A

Vendor: Computer Associates International

In Business Since:	1976
Address:	12120 Sunset Hills Road Reston, VA 22090
Marketing Contact:	Stuart Fleagle
Phone Number:	703-709-4767
Fax Number:	703-709-4820
E-mail Address:	
Bulletin Board System:	
Customer Support:	708 505-6783
Training Provided:	Yes
Consulting Support:	Yes
Customization:	Yes
By Vendor:	Yes
By User:	Yes

Pricing:

Single CPU Price:	$14,000-$60,000
Site License:	N/A
Multicopy Price:	$9,150-$41,000
GSA Price:	Same as single CPU Price.
Maint. Price:	$3,400-$15,000

Platform(s)/Operating System(s):
IBM Mainframes - MVS/SP 1.3.5 or higher.
MVS/XA 2.1.3 or higher, MVS/ESA 3.1 or higher.

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)
TSO/ISPF 2.1 or higher.
IBM VS/COBOL 2.4 compiler run-time library or IBM COBOL II run-time library.
PANAPT VSAM Control Files defined with share options (4.3).
DASD Req: 24 CYL - 3380 space.
Max Batch Region: 4096K.
User Interface: TSO/ISPF.
TSO address space: 2048K.

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)
DBMS environments: DB2, IMS, VSAM, Model 204, IDMS/R, ADABAS/NATURAL, FOCUS, MANTIS, ORACLE; GENER/OL, EASYTRIEVE PLUS, CSP, MARK IV, RAMIS, CA-PANVALET, CA-LIBRARIAN, OS/PDS, CA-PAN/MERGE, CA-1 TMS,
CA-7, TSO/ISPF, IMS/DC, CICS, CA-TELON, CA-PAN/LCM Lifecycle Manager,
and CA-NETMAN.

Description/Purpose: (Identify support for Ada, 2167A)
CA-PANAPT is an automated production turnover system that controls, moves, tracks, and provides inventory of all entities and levels of approval to complete each step in the turnover process. CA-PANAPT eliminates paperwork by supporting on-line change requests, change authorizations, and status information. Emergency fixes and production backouts are automated, reducing the possibility of accidental or fraudulent changes at times when quick turnarounds are mandatory. Contains history of the production turnover process and provides complete control of programs, applications, and systems being moved to the production environment.

CASEWARE

Product Information:

Version Number:	3.1
Date of Last Release:	Aug 93
Date of First Release:	Feb 90
Frequency of Updates:	Annual
Number Sold:	4,000 +

Vendor: CaseWare, Inc.

In Business Since:	1986
Address:	108 Pacifica, 2nd Floor Irvine, CA 92718
Marketing Contact:	Alex Lobba
Phone Number:	714-453-2200
Fax Number:	714-453-2276
E-mail Address:	Dave@cwi.com
Bulletin Board System:	
Customer Support:	support@cwi.com
Training Provided:	Yes
Consulting Support:	Yes
Customization:	Yes
By Vendor:	Yes
By User:	Yes

Pricing:

Single User Price:	$5,600
Site License:	N/A
Multicopy Price:	Varies w/qty
GSA Price:	N/A
Maint. Price:	15%

Platform(s)/Operating System(s):

SPARC - SunOS 4.1.x
SPARC - Solaris 2.2, 2.3
HP 9000/300.400 - HP-UX 8.0.x (Interface only)
HP 9000/700.800 - HP-UX 8.0.x, 9.0.x
DG AViion - DG-UX 5.4.2
DEC RISC - Ultrix 4.3
IBM/RS/6000 - AIX 3.2

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)

Sun SPARC 2/HP 9000 710 RAM: 48 MB, 25 Simultaneous Sessions
RAM Per Session: Interface (2.3 MB), Engine (4 MB), DB Server (1 MB)
Disk Requirements: 30 MB (CaseWare), 70 MB (DB Space), 1.5 * Project Size (in MB)

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)

Centerline CodeCenter (4.0), ObjectCenter (2.0)
IDE STP (4.2 D)
Softbench (B.00), WorkBench (A.0.2)
FrameMaker (3.1X)

Description/Purpose: (Identify support for Ada, 2167A)

CaseWare is a product with Verdix Ada Integration (Verdix 6.0.X), full build capability, host/cross-compiler support, dependency analysis, and Alsys Ada Word Integration (5.3, 5.4, 5.5). It is a client/server-based software configuration management system that provides complete control over development and maintenance activities. It can be used by software engineers, project managers, quality control engineers, technical writers, and other team members to control not only software but also related data such as documentation and designs. It does not require that you use a particular development methodology or process. Rather, it can be customized to implement, automate, and enforce a development process that best meets your unique requirements. Thus, it devlivers the flexibility to meet today's changing demands for software engineering.

CHANGE ACTION

Product Information:

Version Number:	4
Last Released:	Oct 1993
First Released:	Feb 1989
Freq. of Updates:	3 per year
Number Sold:	120

Pricing:

Single User Price:	Contact vendor.
Site License:	Contact vendor.
Multicopy Price:	Contact vendor.
GSA Price:	Contact vendor.
Maint Price:	Contact vendor.

Vendor: Mazda Computer Corporation/ Action Software International

In Business Since:	1980
Address:	20 Valleywood Drive Suite 107 Markham, Ontario, Canada L3R 6G1
Marketing Contact:	Grant King
Phone Number:	905-470-7113
Fax Number:	905-470-6507
E-mail Address:	N/A
Bulletin Board System:	N/A
Customer Support:	416-543-8500
Training Provided:	Yes
Consulting Support:	Yes
Customization:	Yes
By Vendor:	Yes
By User:	Yes

Platform(s)/Operating System(s):
Mainframe computers with MVS-GSA or XA.

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)
Minimum 50 CYL for trial.

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)

Description/Purpose: (Identify support for Ada, 2167A)
Change Action will automatically track and control changes to data sets on an MUS-XA or ESA mainframe computer. Change Action provides significant reductions in problem determination time with automatic reporting and scan capabilities for investigating changes. The continuous audit requirement for managing system changes has been satisfied. The Change Action Reference Tracking component is used to determine which members of your libraries have not been used for a long time. Change Action Info/Interface component is also available.

CHANGE MANAGER FOR DB2

Product Information:

Version Number:	3.3.0.1
Last Released:	Dec 1993
First Released:	Apr 1992
Freq. of Updates:	Quarterly
Number Sold:	N/A

Pricing:

Single User Price:	CPU-based.
Site License:	TIER.
Multicopy Price:	
GSA Price:	Available.
Maint. Price:	Contact vendor.

Vendor: BMC Software

In Business Since:	1980
Address:	2101 City West Blvd.
	Houston, TX 77042
Marketing Contact:	Mike James
Phone Number:	1-800-841-2031
Fax Number:	713-918-8000
E-mail Address:	N/A
Bulletin Board System:	N/A
Customer Support:	1-800-537-1813
Training Provided:	Yes
Consulting Support:	Yes
Customization:	No
By Vendor:	No
By User:	No

Platform(s)/Operating System(s):
MVS/XA.
MVS/ESA.

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)
Works with Bachman case tool to update the data mode when changes are made outside of the case tool.

Description/Purpose: (Identify support for Ada, 2167A)
Change Manager for DB2 automatically migrates changes to DB2 structures. Provides the ability to create versions of structures to allow changes to be backed out. Preserves data and dependent structures. Synchronizes all copies of data structures across multiple subsystems. Allows fallback to a previously saved structure and data version. Allows sychronization of data structures between CASE tools and DB2 subsystems.

CHANGEMAN

Product Information:

Version Number:	3.3.2
Date of Last Release:	May 93
Date of First Release:	Mar 88
Frequency of Updates:	Annual
Number Sold:	170

Note: Release 4.1.0 scheduled for 2nd qtr 1994.

Pricing: Starts at 50K/CPU

Single User Price:	See above
Site License:	available
Multicopy Price:	discounts for multi-site
GSA Price:	Yes, call
Maint. Price:	18%

Vendor: Optima Software, Inc.

In Business Since:	1988
Address:	2277 Fair Oaks Blvd. #495 Sacramento, CA 95825
Marketing Contact:	Ms. Jamie Madison
Phone Number:	916-646-3800
Fax Number:	916-646-3466
E-mail Address:	
Bulletin Board System:	
Customer Support:	Serena International @ 415-696-1800
Training Provided:	Yes
Consulting Support:	Yes
Customization:	Yes
By Vendor:	Yes
By User:	Yes

Platform(s)/Operating System(s):
IBM 370, 390X, 9000 series, and plug compatibles. All releases of MVS/XA and MVS/ESA, OS/2, Windows, and Windows/NT support available in late 1994.

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)
@ 4 cylinders 3390 DASD to store the CHANGE MAN libraries.
@ 80 cylinders of 3390 DASD to store historical data from the Master Control File (Package Master).
Started Task region size of 2 meg. Program runs above the 16 meg XA line.

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)
Interfaces available to DB2, IMS, and MANTIS.
Telon, IEF, Pacbase, and APS - ability to interface with other products.
Support for standard IBM compilers.
Interfaces to documentation tools: Docu/Text, jobscan, JCLprep, JCLcheck.
Other interfaces - Intertest, SAS, all security systems, job schedules, and IBM's INFO/MAN.

Description/Purpose: (Identify support for Ada, 2167A)
CHANGE MAN is a complete software change implementation management system for the entire lifecycle. Includes: library management, version control, configuration management, delta storage, source to load synchronization, load module fingerprinting, audit and audit trails, on-line approvals, concurrent development support, auto production installation (local and remote sites), and backout management. Special features - no proprietary formats, started task architecture, use existing libraries without conversion, fast implementation, and comprehensive reports.

CLEARCASE

Product Information:

Version Number:	1.1.3
Date of Last Release:	Jan 94
Date of First Release:	Jun 92
Frequency of Updates:	Bi-annual
Number Sold:	7,000 +

Vendor: Atria Software, Inc.

In Business Since:	1990
Address:	24 Prime Park Way Natick, MA 01760
Marketing Contact:	
Phone Number:	508-650-5100
Fax Number:	508-650-1196
E-mail Address:	info@atria.com
Bulletin Board System:	
Customer Support:	508-650-5151
Training Provided:	Yes
Consulting Support:	Yes
Customization:	Yes
By Vendor:	Yes
By User:	Yes

Pricing:

Single User Price:	$4,000
Site License:	Call
Multicopy Price:	Call
GSA Price:	Call
Maint. Price:	15%

Platform(s)/Operating System(s):

AVAILABLE TODAY	SCHEDULED PORTS
SUN SPARC/SUNOS 4.X, SOLARIS 2.X	Alpha/OSF Q2 '94
HP 700/HPUX 9.X	Alpha,NT Q3 '94
HP800/HPUX 9.X	Intel/NT Q3 '94
SGI/IRIX 5.X	

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)
Client: 32 MB RAM, 400 MB Disk
Server: 64 MB RAM, 1GB Disk

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)
Key concept is transparent use with all tools, thus not requiring integrations just to be able to version the objects produced by a tool. Integrations: Softbench Encapsulation & Tooltalk Encapsulation, Scopus/ProTeam Tracking, Qualtrack/DDTS Defect Tracking, FrameMaker, and Interleaf. Planned Integrations: Centerline, Code Center, and Object Center, IDE, STP, and Lucid.

Description/Purpose: (Identify support for Ada, 2167A)
Atria's ClearCase product is the premier software configuration management system for UNIX development environments. ClearCase is built for distributed, client/server networks supporting both small and large scale development efforts. ClearCase supports five fundamental capabilities for software development: Version Control, Environment Management, Build Management, Defect Tracking, and Process Control. Through a concept called "Transparency," ClearCase offers the developer a "work-in-place" model for software development giving them the most powerful SCM system available with the lowest impact on the existing development environment. ClearCase is language independent, "thus all languages" source code (including Ada) can be managed. ClearCase's ability to implement Policy/Process enforcement allows for 2167 A/B, SEI, and ISO 9000 support.

CMVC

Product Information:

Version Number:	2.1
Date of Last Release:	Jan 94
Date of First Release:	Mar 92
Frequency of Updates:	Annual
Number Sold:	

Vendor: IBM

In Business Since:	
Address:	1133 Westchester Ave. White Plains, NY 10604
Marketing Contact:	Dean Harrison
Phone Number:	213-621-5605
Fax Number:	213-621-5537
E-mail Address:	
Bulletin Board System:	
Customer Support:	
Training Provided:	Yes
Consulting Support:	Yes
Customization:	Yes
By Vendor:	Yes
By User:	Yes

Pricing:

Single User Price:	
Site License:	
Multicopy Price:	
GSA Price:	
Maint. Price:	

Platform(s)/Operating System(s):
RS/6000 - AIX 3.2
HP - HP/UX
Sun - Sun/OS

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)
Disk - 400 MB
RAM - 64 MB
X11 Motif
TCP/IP

One of the following is required:
SYSBASE
INFORMIX
ORACLE
DB2/6000

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)
Workbench/6000
Softbench/6000

Description/Purpose: (Identify support for Ada, 2167A)
CMVC is a software configuration management tool that provides application developers with configuration management and change control (or versioning) integrated with design and defect tracking with heterogeneous environments. With configurable fields, CMVC defines, stores, and maintains a certain set of attributes for each CMVC object. CMVC offers GUI enhancements for ease of use and shortens the learning curve and lessens development complexity with the graphical browser.

CMVISION (CMV)

Product Information:

Version Number:	1.0
Date of Last Release:	Jun 93
Date of First Release:	
Frequency of Updates:	Annual
Number Sold:	

Vendor: Expertware

In Business Since:	
Address:	12901 Alcosta Blvd. Suite 2A, P.O. Box 1847 San Ramon, CA 94583
Marketing Contact:	Peggy L. Siers
Phone Number:	510-867-0315
Fax Number:	510-867-1933
E-mail Address:	
Bulletin Board System:	
Customer Support:	
Training Provided:	Yes
Consulting Support:	Yes
Customization:	Yes
By Vendor:	Yes
By User:	No

Pricing:

Single User Price:	See below
Site License:	
Multicopy Price:	$18,000 for 3 users
GSA Price:	
Maint. Price:	18%

Platform(s)/Operating System(s):
SunOS, HP, DEC/Ultrix, Xenix, IBM, AIX. Most Unix base platforms.

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)
RAM - Minimal - 4 MB
Recommended - 8 MB
Disk Space - Minimal - 8 MB
Recommended - 10 MB

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)

Description/Purpose: (Identify support for Ada, 2167A)
CMVision is a Motif-based, graphical configuration management, program reporting, and electronic forms control system. The heart of CMVision is its tree display, a graphical hierarchy of directories and files. CMVision's many configuration management features are invoked on objects chosen from the tree. CMVision can store any file type in delta format using standard SCCS or RCS. CMVision includes a fully integrated problem reporting feature. It goes one step further in automating the paperwork associated with the problem reporting activity. It supports a unique form management system that can customize not only problem reporting forms, but any type of form. CMVision supports several interfaces to match the needs of different users, including extensive command lines, character mode interfaces and macro definition facilities. CMVision also provides 11 types of version description reports, Make-build support, user-specific default environment specifications, parallel development, virtual views of directory and file structures, branch baselining, linked files, and complete transaction history recording and archiving.

COMPAREX

Product Information:

Version Number:	8.1.0
Last Released:	Apr 1994
First Released:	1981
Freq. of Updates:	Annually
Number Sold:	1,300 mainframe.

Pricing: MVS Pricing

Single User Price:	$15,000 - $65,000
Site License:	Contact vendor.
Multicopy Price:	Contact vendor.
GSA Price:	Contact vendor.
Maint. Price:	Contact vendor.

Vendor: Sterling Software

In Business Since:	
Address:	9340 Owensmouth Ave. Chatsworth, CA 91313-2210
Marketing Contact:	John Misurek
Phone Number:	818-716-1616
Fax Number:	818-998-2171
E-mail Address:	
Bulletin Board System:	
Customer Support:	
Training Provided:	Yes
Consulting Support:	Yes
Customization:	Yes
By Vendor:	Yes
By User:	Yes

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)
MVS/SP, MVS/XA, MVS/ESA, DOS/VSE, VSE/ESA, VM/CMS.
PC-DOS, MS-DOS.

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)
MS-DOS and PC-DOS 5.0 or greater.
1MB hard disk space.
2MB RAM.

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)
Comparex interfaces with IMS, DL/I, DB2, ADABAS, CA-Datacom/DB, CA-IDMS/DB, CA-Ramis, VSAM, PDS, CA-Panvalet, GEM, IAM, CA-Librarian, Power, CA-Roscoe, Wylbur, and Focus.

Description/Purpose: (Identify support for Ada, 2167A)
Comparex is a comprehensive comparison utility that compares the contents of any two libraries, directories, files or databases, isolates any changes and reports the differences. Comparex runs either as a batch job or with an ISPF interface under TSO.

CONTROL

Product Information:

Version Number:	11
Last Released:	Jan 1994
First Released:	Jan 1981
Freq. of Updates:	9 Months
Number Sold:	400

Pricing:

Single User Price:	$9,600
Site License:	Contact vendor.
Multicopy Price:	Contact vendor.
GSA Price:	$9,600
Maint. Price:	Contact vendor.

Vendor: Network Concepts, Inc.

In Business Since:	1979
Address:	201 Littleton Road Morris Plains, NJ 07950-2932
Marketing Contact:	Richard Ward
Phone Number:	(201) 285-0202
Fax Number:	(201) 285-1198
E-mail Address:	
Bulletin Board System:	
Customer Support:	201-285-0202
Training Provided:	Yes
Consulting Support:	Yes
Customization:	No
By Vendor:	No
By User:	No

Platform(s)/Operating System(s):
CONTROL operates on the minimum available Tandem configurations. (CONTROL-CS Client requires 386 or higher PC, 4 MB RAM, Windows 3.1, and XNS-NETBIOS or TCP/IP LAN Support and software).

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)
Tandem Computers, Incorporated
NONSTOP II, TXP, VLX, CYCLONE, CYCLONE/R, CLX, CLX/R.
K100, K1000, K10000.
Guardian Release C30.06-C30.09, D20.

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)

Description/Purpose: (Identify support for Ada, 2167A)
CONTROL provides a full-spectrum software maintenance and management system similar to mainframe programs. It is a productivity tool that helps organize and monitor status of software components and systems during all phases of the lifecycle. CONTROL compresses multiple versions of source into a single file by automatically computing changes between successive versions; keeps an audit trail and history log of source modifications, when it changed, and who changed it. CONTROL adds a security layer that provides extra file protection and allows flexible authorization procedures for source updates. In addition, CONTROL provides a wide range of historical reports and queries; assists in the system-building process by direct compilation from CONTROL files to compilers inserting the appropriate versions of copylibs as required. CONTROL tracks object files and identifies the specific source file versions that went into each object and has an extensive on-line help facility, documentation, and an interactive tutorial program.

DDTs

Product Information:

Version Number:	3.1
Date of Last Release:	Jan 94
Date of First Release:	Dec 88
Frequency of Updates:	Bi-annual
Number Sold:	15,000 licenses

Vendor: Qualtrak Corp.

In Business Since:	1988
Address:	3160 De La Cruz Blvd
.	STE 206
	Santa Clara CA 95054
Marketing Contact:	Richard Lin
Phone Number:	408-748-9500 ext. 121
Fax Number:	408-748-8468
E-mail Address:	support@qualtrak.com
Bulletin Board System:	
Customer Support:	
(Note: The following are included for a fee)	
Training Provided:	Yes
Consulting Support:	Yes
Customization:	Yes
By Vendor:	Yes
By User:	Yes

Pricing: $9,500 (10 licenses)

Single User Price:	See Above
Site License:	Call
Multicopy Price:	Call
GSA Price:	N/A
Maint. Price:	$2,850 (2 yrs.)

Platform(s)/Operating System(s):
Sun - Sun OS 4.1.X, Solaris 2.X
IBM RS 6000/AX
HP - HP-UX 8.0, 9.0
DEC - UHRIX/OSF
PC & Mac through X-server or Telnet

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)
RAM - 8 Meg
Disk - 40 Meg
UI - both X11 Motif and TTY terminal
(Network independent)

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)
HP Softbench, Sun ToolTalk, Atria ClearCase, Answer Apriori, SMDS Aide-de-Camp, Intersolv PVCS, Legent TeamNet, and Oracle Sybase and RDBMS.

Description/Purpose: (Identify support for Ada, 2167A)
DDTs offers defect tracking, change management, general issue tracking, help desk, and trouble ticket tracking. DDTs supports 2167A conforming metrics. DDTs comes with more than twenty types of management reports, including defect arrival rate graphs, defect resolution rate graphs, bug counts by project and severity, bug counts by engineer and severity, bug counts by project and status, bug counts by engineer and status, full-page bug details, three-line bug summaries, and summaries sorted by requested fields. Also, included is a rich query facility that answers questions such as "What are all the bugs assigned to Jane or Bob that are severity one or two for projects XXX and YYY?

DELTA

Product Information:

Version Number:	1.0
Last Released:	Aug 1993
First Released:	Aug 1993
Freq. of Updates:	Annually
Number Sold:	Unknown

Pricing:

Single User Price:	$337
Site License:	$1,335/5 user.
	$4,998/20 user.
Multicopy Price:	$319
GSA Price:	N/A
Maint. Price:	Contact vendor.

Vendor: Microsoft Corporation

In Business Since:	1983
Address:	90 Industrial Park Rd
	Hingham, MA 02043
Marketing Contact:	Ken Glansberg
Phone Number:	800-421-8006, Ext. 1436
Fax Number:	617-749-2018
E-mail Address:	None
Bulletin Board System:	None
Customer Support:	800-421-8006
Training Provided:	No
Consulting Support:	Yes
Customization:	
By Vendor:	
By User:	

Platform(s)/Operating System(s):
Microsoft Windows 3.1 or greater.

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)

DOS 5.0 or greater.	5 MB hard disk space.
Windows 3.1 or greater.	VGA resolution or greater.
4 MB RAM.	Mouse or compatible pointing device.

Networks: Novell; LAN Manager; LANtastic, Windows for Workgroups.

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)
Version Control.

Description/Purpose: (Identify support for Ada, 2167A)
Delta by Microsoft Corporation is a version control system for Windows. Features include: Single command download of latest version from master project on network, automatic concurrent file access merging, ability to display versions of files side by side with differences identified and color coded, ability to see status of all project files at a glance. Manage source code for any language that uses ASCII files.

HISTORIAN PLUS

Product Information:

Version Number:	4.3
Date of Last Release:	Sep 92
Date of First Release:	1978
Frequency of Updates:	As needed
Number Sold:	

Vendor: OPCODE, Inc.

In Business Since:	1971
Address:	P.O. Box 26309 Austin, TX 78755

Marketing Contact:

Phone Number:	512-346-7090
Fax Number:	512-346-8522
E-mail Address:	
Bulletin Board System:	
Customer Support:	
Training Provided:	
Consulting Support:	
Customization:	
By Vendor:	
By User:	

Pricing:

Single User Price:	Call
Site License:	Call
Multicopy Price:	Call
GSA Price:	
Maint. Price:	Call

Platform(s)/Operating System(s):
APOLLO AEGIS; CDC NOS, NOS/BE, NOS/VE, SCOPE 2; CDC CYBER 205 VSOS; CONCURRENT OS, Convex Convexos; Cray COS, CTSS, UNICOS, Data General AOS/VS, DG/UX; DEC-VAX VMS, UNIX; DIPS OS; ELXSI EMBOS; FUJITSU FACOM OS; HARRIS VULCAN, VOS; HITACHI VOS; HP 9000 HP UX; IBM AIX; MVS, VM; NEC ACOS4, ACOS6, SXOS; NORSK DATA SINTRAN; PRIME PRIMOS; SIEMENS BS2000; SILICON GRAPHICS IRIX; SUN SUNOS; UNIVAC EXEC 8.

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)
Depends on the CPU. Programs are designed to be "environmental neutral." Three primary executable modules. In "early bind" configuration less than 1 MB each. In "late bind," smaller yet.

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)
Depends on the CPU/OS combination.

Description/Purpose: (Identify support for Ada, 2167A)
Historian Plus is a software configuration management system that enables storage/updates to source materials in one library, while tracking changes. Features include: storage of multiple definable versions; detailed history; rescindable modification(s); and identification scheme that flags overlapping modifications, and enhancies multiple programmer interaction. Operates on most systems, giving a consistent and known application across machine boundaries.

INFORMATION ASSET MANAGEMENT

Product Information:

Version Number:	3.02
Date of Last Release:	Oct 93
Date of First Release:	1987
Frequency of Updates:	9 months
Number Sold:	2,000

Pricing:

Single User Price:	$7,590
Site License:	Yes
Multicopy Price:	Yes
GSA Price:	N/A
Maint. Price:	18%/yr.

Vendor: Atherton Technology

In Business Since:	
Address:	39350 Civic Center Dr. Suite 430 Fremont, CA 94538
Marketing Contact:	Marrion Sweeney
Phone Number:	510-494-8411
Fax Number:	510-494-1776
E-mail Address:	
Bulletin Board System:	
Customer Support:	800-984-7233
Training Provided:	Yes
Consulting Support:	Yes
Customization:	Yes
By Vendor:	Yes
By User:	Yes

Platform(s)/Operating System(s):

Platforms		Operating Systems	
Sun Sparc	Sun Solaris	Sun OS 4.1.1	HP/UX 9.0
HP 9000/700	IBM RS/6000	Solaris 2.2	Ultrix 4.2
DEC Station	SGI IRIS	AIX 3.2	DG/UX 5.4.2
DG Aviion		IRIX 5.2	

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)

RAM-16MB DISK 15MB Swapfile-UNIX 40MB
Pagefile/Pagespace: 80,000 Blocks

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)

Seamless encapsulation of any tool or process (written in any programming language) can be integrated without modification. Interleaf 5, Cadre Teamwork, IDE Software through Pictures, and HP SoftBench, IBM Workbench/6000, and Centerline CodeCenter are also supported.

Description/Purpose: (Identify support for Ada, 2167A)

Information Asset Management is designed to upgrade the quality of information, IAM expands the capability and improves the usefulness of existing information resources. Accessible from any platform across a network, it provides the access and control to quickly generate quality information for people who need it. This open Client/Server architecture reduces overhead costs, protects investments in existing technologies, and provides a foundation for the future. The system allows organization, manipulation, maintenance, and security of data and information assets. The management and control functions deliver better solutions in less time, for a lower cost. With the system comes: Version Mgmt, Process Mgmt, Configuration Mgmt, Workflow Mgmt, Access Control, Historial information, Reuse, Context Mgmt, Merge, Security, Tool Integration, Audit Trails, Data Integration, Process Integration, Metrics; all based on an object-oriented repository.

MAXTRAC

Product Information:

Version Number:	2.1.1
Date of Last Release:	
Date of First Release:	
Frequency of Updates:	
Number Sold:	

Vendor: BlueLine Software

In Business Since:	1985
Address:	5775 Wayzata Blvd. Minneapolis, MN 55416
Marketing Contact:	Wayne Hamilton
Phone Number:	612-542-1072
Fax Number:	612-542-9566
E-mail Address:	wayne@blueline.mn.org
Bulletin Board System:	612-542-8431
Customer Support:	800-826-0313
Training Provided:	Yes
Consulting Support:	Yes
Customization:	Yes
By Vendor:	Yes
By User:	No

Pricing:

Single User Price:	contact vendor
Site License:	contact vendor
Multicopy Price:	contact vendor
GSA Price:	contact vendor
Maint. Price:	contact vendor

Platform(s)/Operating System(s):

IBM VM

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)
Client:

Server:Disk: 16 cylinder of 3375 plus temporary work disk of 800 4K blocks.

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)

Uses SQL database.

Description/Purpose: (Identify support for Ada, 2167A)
Provides a central tracking facility for problem reporting, problem resolution, system component tracking, and change tracking.

METHODMANAGER

Product Information:

Version Number:	2.2
Date of Last Release:	Sep 93
Date of First Release:	Nov 90
Frequency of Updates:	Annual
Number Sold:	1,200 worldwide
Date of next release:	Mar 94

Pricing:

Single User Price:	$33,750
Site License:	Not Available
Multicopy Price:	PC prod only: $6,413
GSA Price:	Above
Maint. Price:	15% of current license fee

Vendor: Manager Software Products, Inc.

In Business Since:	1968
Address:	131 Hartwell Avenue Lexington, MA 02173
Marketing Contact:	Jane R. Circle, Sales Mgr.
Phone Number:	617-863-5800
Fax Number:	617-861-6130
E-mail Address:	
Bulletin Board System:	
Customer Support:	800-737-6748
Training Provided:	Yes
Consulting Support:	Yes
Customization:	Yes
By Vendor:	Yes
By User:	Yes

Platform(s)/Operating System(s):
MVS, VM, IBM mainframe or compatible CPU.
IBM-PC or compatible running Windows 3.1.

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)
PC products - 80386 or better workstation, 6 meg of base memory, 8 meg of hard disk space, Windows 3.1.
Mainframe products - IBM 370 architecture or compatible CPU.

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)
Interfaces for: IEW/ADW, Bachman DBA, Intersolv ILR.
Databases supported: IMS, IDMS, DB2, Oracle, Sybase, Informix, or other related databases if needed.
Please contact Manager Software Products, Inc. for additional information.

Description/Purpose: (Identify support for Ada, 2167A)
METHODMANAGER and managerView are an integrated set of Repository Services and Functions to assist organizations in the management of metadata assets: data modeling, design and impact analysis for new development, or the reengineering of legacy systems.

NOTE: Please see GSA Contract GS00K92AGS5980 and ADP Schedule for terms and complete pricing information. METHODMANAGER is only available under the Special Migration Pricing Plan.

MKS RCS

Product Information:

Version Number:	6.1
Last Released:	Nov 1993
First Released:	1987
Freq. of Updates:	Bi-annual
Number Sold:	25,000

Pricing:

Single User Price:	$349
Site License:	Contact vendor.
Multicopy Price:	Contact vendor.
GSA Price:	N/A
Maint. Price:	Incl. with multi-user license.

Vendor: Mortice Kern Systems, Inc.

In Business Since:	1984
Address:	35 King Street North Waterloo, ONT N2J2W9
Marketing Contact:	Chuck Lownie
Phone Number:	519-883-4363
Fax Number:	519-884-8861
E-mail Address:	chuck@mks.com
Bulletin Board System:	
Customer Support:	519-884-2270
Training Provided:	Yes
Consulting Support:	Yes
Customization:	Yes
By Vendor:	No
By User:	Yes

Platform(s)/Operating System(s):

DOS	Sun/OS
Windows	UnixWare
OS/2	386 Unix
Windows NT	AIX
SCO Unix NetWare	

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)
640K and hard drive.

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)
No incompatibilities with any other development tools.

Description/Purpose: (Identify support for Ada, 2167A)
MKS RCS is a complete configuration management system. It offers both binary and text file support, full network support, make/configuration builder, locking, visual differencing, branching, merging, production control, and project management.

OBJECT CM

Product Information:

Version Number:	1.3
Date of Last Release:	Feb 94
Date of First Release:	Feb 94
Frequency of Updates:	Bi-annual
Number Sold:	3

Vendor: Alsys, Inc.

In Business Since:	1980
Address:	10251 Vista Sorrento Pkwy. San Diego, CA 92121
Marketing Contact:	Bill Hart
Phone Number:	619-457-2700
Fax Number:	619-452-1334
E-mail Address:	hart@alsys.com
Bulletin Board System:	
Customer Support:	800-995-2579
Training Provided:	Yes
Consulting Support:	Yes
Customization:	Yes
By Vendor:	Yes
By User:	Yes

Pricing:

Single User Price:	$3,300
Site License:	
Multicopy Price:	$2,450 for 30 $2,250 for 50
GSA Price:	Call
Maint. Price:	20%

Platform(s)/Operating System(s):

Sun Sparc	SunOS
HP9000/7xx	HP/UX
IBM/RS/6000	AIX

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)
32 MB RAM, 150 MB Disk. Motif or Open Look user interface. NFS if distributed development is desired.

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)

Upper CASE:	Cadre TeamWork, IDE Software through Pictures
Frameworks:	Freedom Works, Entreprise II
Databases:	Emeraude PCTE
Compilers:	Alsys Ada, Verdix Ada, C, C++, Fortran
Documentation Tools:	Interleaf, FrameMaker
User Interface Builders:	TeleUse, UIMX
Metrics/Test Tools	Logiscope

Description/Purpose: (Identify support for Ada, 2167A)
Object CM is a highly tailorable configuration management system that is designed to accommodate a wide range of CM needs. In its simplest operational mode, it serves as a repository for versioned files and configurations. In its most sophisticated form, it is a complete development environment, with context-sensitive access to encapsulated tools, management of user tasks and roles, and the ability to define and support software development processes. Object CM's underlying PCTE (Portable Common Tools Environment) repository allows users to organize software engineering work products in a way that reflects the true structure of their project. Object CM includes a code production facility that is language independent, yet includes full support for Ada-specific dependency analysis and program builds. Also included is a 2167A process definition, a tailorable problem tracking and change management system, and communication utilities to support both local and wide-area network development.

OPUS MAKE

Product Information:

Version Number:	6.0
Last Released:	Mar 1993
First Released:	Nov 1987
Freq. of Updates:	Annually
Number Sold:	6,200

Pricing:

Single User Price:	$165 DOS/OS2 $199 Unix
Site License:	Contact vendor.
Multicopy Price:	Discounts available.
GSA Price:	10% discount.
Maint. Price:	$60/license per year.

Vendor: OPUS Software, Inc.

In Business Since:	Nov 1987
Address:	1032 Irvine Street Suite 439 San Francisco, CA 94122

Marketing Contact:

Phone Number:	800-248-OPUS
Fax Number:	415-664-5624
E-mail Address:	72002,1245
Bulletin Board System:	415-664-5694
Customer Support:	415-644-7901
Training Provided:	By special request.
Consulting Support:	Yes
Customization:	Yes*
By Vendor:	Yes*
By User:	Yes*

*Price will vary from above for these services.

Platform(s)/Operating System(s):
Opus Make primarily runs under DOS and OS/2 operating systems. Unix and most Unix styled operating systems are also available. Microsoft NT will be available as of 1 April 1994.

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)
DOS version of Opus Make needs a minimum of 170K of free RAM to execute and requires at least MS-DOS 3.3 or OS/2.1.3.

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)
Opus Make is a configuration management tool, and as such, it provides integration with Burton Systems TLIB, One Tree Source State, and Intersolv PVCS. It is compiler and language independent and can provide project control for many different languages.

Description/Purpose: (Identify support for Ada, 2167A)
Opus Make is a programming tool that helps maintain programs, particularly those that are constructed from several component files. Make controls the entire process of building your program, whether it involves preprocessing files, compiling, linking, or other steps. It automates the process and greatly reduces the amount of time spent rebuilding projects by hand and greatly reduces the number of mistakes that can occur in rebuilding projects. Supplied with Opus Make is a tool called MKMF, which prepares the control file used by Make. Opus Make is the most powerful make utility available to developers. It processes makefiles very quickly and has a broad range of capabilities designed to quickly and reliably build and maintain your software projects. Several of the features found in Opus Make are: minimal memory usage, multiple-directory support, automatic response files, queued shell lines, makefile compatibility, source-code revision support, object library support, Borland Bcc support, extensive macro capabilities, regular-expression syntax, debugging support, makefile directives, chained inference rules, and customization by an initialization file.

PVCS CONFIGURATION BUILDER

Product Information:

Version Number:	5.1
Date of Last Release:	Dec 93
Date of First Release:	Apr 82
Frequency of Updates:	1+ per year
Number Sold:	

Vendor: Intersolv

In Business Since:	1982
Address:	1700 NW 167th Place Beaverton, OR 97006
Marketing Contact:	
Phone Number:	800-547-7827
Fax Number:	503-629-0186
E-mail Address:	Don_Sompi@Beav. cont. Intersolv.com
Bulletin Board System:	Compuserve
Customer Support:	800-547-7827, ext. 610
Training Provided:	
Consulting Support:	
Customization:	
By Vendor:	
By User:	

Pricing:

Single User Price:	Call
Site License:	Call
Multicopy Price:	Call
GSA Price:	N/A
Maint. Price:	Call

Platform(s)/Operating System(s):
Windows, DOS, Windows NT, OS/2, HP-UX, SCO, Sun, Solaris, Interactive, AIX/RS6000.

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)
DOS 3.3 or later, 250K HD, 256K Memory. OS/2 1.3 or later, 250K HD, 4 MB Ext. Memory. DOS Extended 3.0 or later, 250K HD, 1 MB Ext. Memory. Windows 3.1, 250K HD, 4 MB Memory.

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)
Change Management Software to Design and Analyze.

Description/Purpose: (Identify support for Ada, 2167A)
PVCS Configuration Builder is a totally integrated Make utility that records relationships between components and re-creates the specific sequence of steps required to construct a software system reliably, completely, and accurately. Configuration Builder embeds "footprints" of vital information into compiled objects and acts conditionally on footprint information.

PVCS DEVELOPER'S TOOLKIT

Product Information:

Version Number:	5.1
Date of Last Release:	Dec 93
Date of First Release:	Apr 82
Frequency of Updates:	1+ per year
Number Sold:	

Vendor: Intersolv

In Business Since:	1982
Address:	1700 NW 167th Place Beaverton, OR 97006

Marketing Contact:

Phone Number:	800-547-7827
Fax Number:	503-629-0186
E-mail Address:	Don_Sompi@Beav. cont. Intersolv.com
Bulletin Board System:	Compuserve
Customer Support:	800-547-7827, ext. 610

Pricing:

Single User Price:	Call
Site License:	Call
Multicopy Price:	Call
GSA Price:	N/A
Maint. Price:	Call

Training Provided:
Consulting Support:
Customization:
By Vendor:
By User:

Platform(s)/Operating System(s):
Windows, DOS, Windows NT, OS/2, HP-UX, SCO, Sun, Solaris, Interactive, AIX/RS6000.

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)
PVCS Version Manager 5.1, PVCS Configuration Builder 5.1, MS-DOS Version 3.3 or higher or OS/2 1.3 or higher.

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)
Change Management Software to Design and Analyze.

Description/Purpose: (Identify support for Ada, 2167A)
PVCS Developer's Toolkit delivers full PVCS functionality to your development environment or to your existing applications in the form of DLLs, import libraries, and header files. The scope and quality of the toolkit meets IBM and other programming standards for Application Programming Interface implementation.

PVCS PRODUCTION GATEWAY

Product Information:

Version Number:	5.1
Date of Last Release:	Dec 93
Date of First Release:	Apr 82
Frequency of Updates:	1+ per year
Number Sold:	

Vendor: Intersolv

In Business Since:	1982
Address:	1700 NW 167th Place Beaverton OR 97006
Marketing Contact:	
Phone Number:	800-547-7827
Fax Number:	503-629-0186
E-mail Address:	Don_Sompi@Beav. cont. Intersolv.com
Bulletin Board System:	Compuserve
Customer Support:	800-547-7827 ext. 610
Training Provided:	
Consulting Support:	
Customization:	
By Vendor:	
By User:	

Pricing:

Single User Price:	Call
Site License:	Call
Multicopy Price:	Call
GSA Price:	N/A
Maint. Price:	Call

Platform(s)/Operating System(s):
Windows, DOS, Windows NT, OS/2, HP-UX, SCO, Sun, Solaris, Interactive, AIX/RS6000.

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)
To use PVCS Production Gateway on a LAN, you must have the following: An IBM PS/2, PC/486, PC/386, PC/AT, or compatible; and an SNA (Systems Network Architecture) network. Also, one of the following: DOS Ver 5.0 or greater, Microsoft Windows Ver 3.1, and IBM Networking Services/DOS Ver 1.01 (w/fix IC05847) or Ver 1.1; OS/2 Presentation Manager Ver 1.3, and OS/2 Networking Services/2; OS/2 Presentation Manager 2.1, and OS/2 NTS Network Transport Services and CM/2 Communication Manager; at least 300K of free memory under Windows or 1 MB of free extended memory under Presentation Manager; at least 3 MB of free disk space; a mouse (recommended); and PVCS Version Manager 5.1 or later.

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)

Description/Purpose: (Identify support for Ada, 2167A)
PVCS Production Gateway is a transparent bidirectional link that synchronizes LAN development archives with MVS development libraries. By coordinating development libraries in host-based library management and code control services (Endevor, PANVALET, Librarian, PDS) with development objects on the LAN (including PVCS archives), PVCS Production Gateway allows MVS development and LAN-based development while enforcing standards and providing an audit trail on the LAN.

PVCS REPORTER

Product Information:

Version Number:	5.1
Date of Last Release:	Dec 93
Date of First Release:	Apr 82
Frequency of Updates:	1+ per year
Number Sold:	

Vendor: Intersolv

In Business Since:	1982
Address:	1700 NW 167th Place Beaverton, OR 97006
Marketing Contact:	
Phone Number:	800-547-7827
Fax Number:	503-629-0186
E-mail Address:	Don_Sompi@Beav. cont. Intersolv.com
Bulletin Board System:	Compuserve
Customer Support:	800-547-7827, ext. 610
Training Provided:	
Consulting Support:	
Customization:	
By Vendor:	
By User:	

Pricing:

Single User Price:	Call
Site License:	Call
Multicopy Price:	Call
GSA Price:	N/A
Maint. Price:	Call

Platform(s)/Operating System(s):
Windows, DOS, Windows NT, OS/2, HP-UX, SCO, Sun, Solaris, Interactive, AIX/RS6000.

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)
Microsoft Windows 3.0 or later, IBM Presentation Manager 1.3 or later, or PVCS Version Manager 5.0 or later.

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)
Change Management Software to Design and Analyze.

Description/Purpose: (Identify support for Ada, 2167A)
PVCS Reporter lets you quickly produce reports using an advanced Graphical User Interface to access project information managed by PVCS using pre-defined queries or you build yourself. PVCS Reporter queries access multiple projects in distributed architecture's to select, merge, sort, and display exactly what you need.

PVCS VERSION MANAGER

Product Information:

Version Number:	5.1
Date of Last Release:	Dec 93
Date of First Release:	Apr 82
Frequency of Updates:	1+ per year
Number Sold:	

Vendor: Intersolv

In Business Since:	1982
Address:	1700 NW 167th Place Beaverton, OR 97006
Marketing Contact:	
Phone Number:	800-547-7827
Fax Number:	503-629-0186
E-mail Address:	Don_Sompi@Beav. cont. Intersolv.com
Bulletin Board System:	Compuserve
Customer Support:	800-547-7827, ext. 610
Training Provided:	
Consulting Support:	
Customization:	
By Vendor:	
By User:	

Pricing:

Single User Price:	Call
Site License:	Call
Multicopy Price:	Call
GSA Price:	N/A
Maint. Price:	Call

Platform(s)/Operating System(s):
Windows, DOS, Windows NT, OS/2, HP-UX, SCO, Sun, Solaris, Interactive, and AIX/RS6000.

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)
DOD 3.3 or later, 250 K HD, 256K Memory. OS/2 1.3 or later, 250K HD, 4 MB Ext. Memory. DOS Extended 3.0 or later, 250 K HD, 1 MB Ext. Memory. Windows 3.1, 250 K HD, 4 MB Memory.

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)
Change Management Software to Design and Analyze.

Description/Purpose: (Identify support for Ada, 2167A)
PVCS Version Manager oversees changes to elements that comprise a software system automating revision, version, build, promotion, and release management. Version Manager supports all development objects including source code, ASCII files, graphics, documentation, and binary files. Version Manager is a heterogeneous solution supporting DOS, Windows, Windows NT, OS/2, and UNIX.

REUSE MANAGEMENT

Product Information:

Version Number:	1.0
Date of Last Release:	Feb 94
Date of First Release:	Feb 94
Frequency of Updates:	9 months
Number Sold:	50

Pricing:

Single User Price:	$4,990
Site License:	Yes
Multicopy Price:	Yes
GSA Price:	N/A
Maint. Price:	18%

Vendor: Atherton Technology

In Business Since:	
Address:	39350 Civic Center Dr.
Suite 430	Fremont, CA 94538
Marketing Contact:	Marrion Sweeney
Phone Number:	510-494-8411
Fax Number:	510-494-1776
E-mail Address:	
Bulletin Board System:	
Customer Support:	800-984-7233
Training Provided:	Yes
Consulting Support:	Yes
Customization:	Yes
By Vendor:	Yes
By User:	Yes

Platform(s)/Operating System(s):

Platforms	Operating Systems
Sun Sparc	Sun OS 4.11
Sun Solaris	Solaris 2.2
IBM RS/6000	AIX 3.2
SGI IRIS	IRIX 5.2
HP 9000/700 series	HP/UX 9.0
DEC Station	Ultrix 4.2
DG Aviion	DG/UX 5.4.2

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)

RAM - 16 MB DISK 15 MB
Pagefile/Pagespace: 80,000 Blocks
Swapfile-UNIX 40MB

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)

Special customization can be provided.

Description/Purpose: (Identify support for Ada, 2167A)

Reuse Management System is a powerful distributed object framework that provides an "Automated Library" for reusable software components, which may include: Requirements, Source Code, User Documentation, Test Plans and Results, Data Generated by Any Tool, or Code written in any Language. The System enables developer's to identify and reuse high-quality, error-free components, which may be customized for future projects rather than spending expensive, limited resources to build each new application from scratch. Software Development efforts will deliver better solutions in less time, for a lower cost, while avoiding duplication of effort.

Ada, 2167A: 2167A types are supplied.

RTM

Product Information:

Version Number:	2.2
Last Released:	Jan 1994
First Released:	1986
Freq. of Updates:	6 months
Number Sold:	2,000

Pricing:

Single User Price:	Contact vendor.
Site License:	Contact vendor.
Multicopy Price:	Contact vendor.
GSA Price:	Contact vendor.
Maint. Price:	

Vendor: Marconi Systems Tech.

In Business Since:	1984
Address:	4115 Pleasant Valley Rd Suite 100 Chantilly, VA 22021
Marketing Contact:	Paul Raymond
Phone Number:	703-263-1260
Fax Number:	703-263-1533
E-mail Address:	sales@mstus.com
Bulletin Board System:	
Customer Support:	703-263-1260
Training Provided:	Yes
Consulting Support:	Yes
Customization:	Yes
By Vendor:	Yes
By User:	Yes

Platform(s)/Operating System(s):

SUN	SUN/OS 4.1.3
SUN	SOLARIS 2.2
IBM RS/6000	AIX 3.2.5
HP 9000/700	HPUX 9.0.1
VAX	VMS 5.2

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)

Varies according to platform. Contact vendor.

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)

Teamwork	FrameMaker
Software through Pictures	Microsoft Word
RDD-100	WordPerfect
Interleaf	

Description/Purpose: (Identify support for Ada, 2167A)

RTM is a fully configurable system for tracing requirements to any information across a full project lifecycle. Integrations with Cadre's Teamwork and IDE's Software through Pictures provide direct access to RTM menus for automated data capture and consistency checking. Requirements documents may be rebuilt in Interleaf, Framemaker, WordPerfect and Word formats for quality reporting.

Within RTM, user defined objects allow any type of data to be stored in the RTM database providing traceability to other objects such as code modules, test specifications, and documentation. RTM is X-Windows/Motif-based and uses Oracle as its underlying database. RTM is language and process independent.

SABLIME

Product Information:

Version Number:	3.1
Date of Last Release:	Jun 93
Date of First Release:	Apr 87
Frequency of Updates:	12-15 months
Number Sold:	50 (approx.)

Vendor: AT&T Bell Laboratories

In Business Since:	
Address:	600 Mountain Ave. Murray Hill, NJ 07974
Marketing Contact:	Ed Cartier
Phone Number:	908-580-5719
Fax Number:	908-580-6355
E-mail Address:	attmail:ecartier
Bulletin Board System:	
Customer Support:	508-582-7118
Training Provided:	
Consulting Support:	
Customization:	
By Vendor:	
By User:	

Pricing:

Single User Price:	$5,000
Site License:	Negotiable
Multicopy Price:	sliding scale $5,000 - $200
GSA Price:	
Maint. Price:	15%

Platform(s)/Operating System(s):
AT&T 3B2-400 and 6386, Bull DPX2, HP 9000/3xxx-7xx, NCR 3345, StarServer E and S, Suns. AT&T 3B2 500-800, Motorola 68030, VAX 11/7xx, AT&T 3E-1000 and 7020, VAX 8xx0, HP 9000/8xx, Pyramid 9825, AT&T StarServer FT, Tandems, AT&T 7040 and 7080, Amdahls, and IBMs.

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)
Any standard Unix configuration from a workstation on up.

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)
Sablime operates with any compiler and editor using standard ASCII text to generate source code. Sablime is compatible with AT&T Documentator's Workbench (DWB) and FrameMaker. Release 4.0 of Sablime (Q3 1994) will be able to manage binary output from data bases, compilers, and 4 GL systems.

Description/Purpose: (Identify support for Ada, 2167A)
Sablime tracks change requests and changes to source files as a result of implementing those change requests. It collects in-process metrics, supports the assignment and distribution of work, is a source for quality data, and supports project communications.

SCONS/3000

Product Information:

Version Number:	1.5
Last Released:	Oct 1993
First Released:	Oct 1987
Freq. of Updates:	
Number Sold:	300

Pricing:

Single CPU Price:	$3,000
Site License:	Contact vendor.
Multicopy Price:	Contact vendor.
GSA Price:	No
Maint. Price:	$450/year

Vendor: Corporate Computer Systems

In Business Since:	
Address:	33 West Main Street Holmdel, NJ 07733
Marketing Contact:	Joan Dillon
Phone Number:	908-946-3800
Fax Number:	908-946-7167
E-mail Address:	
Bulletin Board System:	
Customer Support:	908-946-3800
Training Provided:	Contact vendor.
Consulting Support:	Contact vendor.
Customization:	Yes
By Vendor:	No
By User:	Yes

Platform(s)/Operating System(s):
HP-1000 - RTE-A
HP-300-MPE-V
HP-300-MPE-XL

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)
User interface - Standard HP terminal or equivalent.
Disk space required - approximately 7,000 sectors (including MAKE and GRGP utilities).

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)
- Listing and compiling may be done on a single file, file subset, or all-files basis.
- User exit programs can be written to perform a variety of user-defined operations.
- MAKE and GREP.

Description/Purpose: (Identify support for Ada, 2167A)
SCONS/3000 (Source CONtrol System) is a fourth generation change control system designed to manage all file change problems. Regardless of your programming environment, SCONS/3000 lets you control your project's development without hindering its progress.

The system organizes and maintains all revisions of any type of file, and at the same time controls user access and modifications. SCONS/3000 conserves valuable disk space by storing only the difference between old and new files.

SOURCE MANAGER

Product Information:

Version Number:	2.11
Last Released:	Jan 1994
First Released:	Sep 1991
Freq. of Updates:	Annually
Number Sold:	N/A

Pricing:

Single User Price:	$169 DOS
	$349 Unix
Site License:	$349 DOS
	$699 Unix
Multicopy Price:	Contact vendor.
GSA Price:	N/A
Maint. Price:	N/A

Vendor: TransWare Enterprises, Inc.

In Business Since:	1988
Address:	5450 Thornwood Drive
	Suite M
	San Jose, CA 95123-1222
Marketing Contact:	Virginia Jones
Phone Number:	408-227-7700
Fax Number:	408-227-7757
E-mail Address:	
Bulletin Board System:	
Customer Support:	408-227-7700
Training Provided:	No
Consulting Support:	Yes
Customization:	Yes
By Vendor:	Yes
By User:	No

Platform(s)/Operating System(s):
MS-DOS, UnixWare, Interactive Unix, Solaris X86, AIX.

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)
DOS - 640K RAM.
All platforms: Disk Space - < 500K.

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)
Source_Manager may be used to control text files of any format, including program source files (all compilers) and database command files. Unix and DOS files are easily imported and exported between platforms.

Description/Purpose: (Identify support for Ada, 2167A)
Source_Manager is a software revision and version control program that organizes and protects source code. Source_Manager maintains a comprehensive Program Library file that contains your original source code, all code revisions, date/time stamps, notes, user stamps, passwords, and more. Two modes of operation are featured: 1) Revision Control, allowing revision of individual source lines; 2) Version Control, allowing easy check-out and check-in of complete source modules. Revision histories are maintained in compatible form with CDC's UPDATE utility program.

Source_Manager allows you to develop and test new revisions to your program easily without making a permanent change to your controlled software.

SOURCEBANK

Product Information:

Version Number:	5.2
Date of Last Release:	
Date of First Release:	
Frequency of Updates:	
Number Sold:	

Vendor: BlueLine Software

In Business Since:	1985
Address:	5775 Wayzata Blvd.
	Minneapolis, MN 55416
Marketing Contact:	Wayne Hamilton
Phone Number:	612-542-1072
Fax Number:	612-542-9566
E-mail Address:	wayne@blueline.mn.org
Bulletin Board System:	612-542-8431
Customer Support:	800-826-0313
Training Provided:	Yes
Consulting Support:	Yes
Customization:	Yes
By Vendor:	Yes
By User:	No

Pricing:

Single User Price:	contact vendor
Site License:	contact vendor
Multicopy Price:	contact vendor
GSA Price:	contact vendor
Maint. Price:	contact vendor

Platform(s)/Operating System(s):
IBM VM

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)
Client:

Server: Disk: 40 cylinders of 3380; 5 - 16 MB of memory

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)

Description/Purpose: (Identify support for Ada, 2167A)
Provides centralized access and control of files, including source, object, and data members. Complete version control and security are implemented through either a full-screen user interface or command syntax.

TLIB

Product Information:

Version Number:	5.0.1
Last Released:	
First Released:	
Freq. of Updates:	
Number Sold:	

Pricing:

Single User Price:	$139 (DOS)
Site License:	$195 (OS/2)
Multicopy Price:	Volume discount.
GSA Price:	Contact vendor.
Maint. Price:	Contact vendor.

Vendor: Burton Systems Software

In Business Since:	1984
Address:	5104 Western Blvd. Raleigh, NC 27606

Marketing Contact:

Phone Number:	919-233-8128
Fax Number:	919-233-0716
E-mail Address:	N/A
Bulletin Board System:	919-233-0106
Customer Support:	James Holman/ Dave Burton
Training Provided:	No
Consulting Support:	Yes
Customization:	Yes
By Vendor:	Yes
By User:	No

Platform(s)/Operating System(s):
DOS, OS/2 Windows, Windows NT.

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)
Needs approximately 500K conventional memory free.

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)
Opus Make; Multi Edit, can be used by most makes and editors. Also, macros exist for Slick Edit, Code Wright, and Sage Editor.

Description/Purpose: (Identify support for Ada, 2167A)
TLIB is a version control and configuration management tool. Would have no trouble managing Ada source code. TLIB allows easy migration of changes from one level to another. For example, you can migrate improvements from a "standard" level to each of several "customized" levels. Or, you can migrate bug fixes from the old release into the new release. Or, if you have modified a purchased source code library, when you get new releases from the vendor you can migrate their changes into your own version, without losing your modifications.

VERSION MERGER

Product Information:

Version Number:	3.1
Date of Last Release:	Jan 93
Date of First Release:	Sep 90
Frequency of Updates:	Annual
Number Sold:	226 - U.S.
	12 - Int'l

Pricing: 15K - 21K based on CPU size

Single User Price:	N/A
Site License:	$23,500
Multicopy Price:	N/A
GSA Price:	
Maint. Price:	15%

Vendor: Princeton Softech, Inc.

In Business Since:	1989
Address:	1060 State Road
	Princeton, NJ 08540
Marketing Contact:	Mario M. de Guzman
Phone Number:	609-497-0205
Fax Number:	609-497-0302
E-mail Address:	
Bulletin Board System:	
Customer Support:	800-457-7060
Training Provided:	Yes
Consulting Support:	Yes
Customization:	No
By Vendor:	No
By User:	No

Platform(s)/Operating System(s):
MVS-based. Runs under either TSO/ISPF or CA-Roscoe.

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)
Disk Requirements: - or = 75 tracks of 3380 DASD to install product plus size of input files that need reconciliation.
Memory Requirements: - or = $200K for the on-line dialog. When editing a file, the file is brought into memory, storage needs vary depending on the size of the programs.

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)
Version Merger interfaces with many change control systems, e.g., Endevor, ChangeMan, CCF, Panapt. Millenium transparency. Library systems integration, e.g., Panvalet, Librarian. Language independent.

Description/Purpose: (Identify support for Ada, 2167A)
Version Merger is a programmer's productivity tool that automates the integration of multiple versions of the same application or program. Assists quality assurance people and programmers in identifying changes made to an application or program and retrofitting previous changes to new enhancements. Version Merger automates the reconciliation process and cuts implementation time by 50%. Version Merger is particularly useful for upgrading purchased applications that have been customized to satisfy a company's specific requirements.

VERSIONS 1.1

Product Information: Versions 1.1

Version Number:	1.1
Date of Last Release:	May 94
Date of First Release:	Sep 93
Frequency of Updates:	As developed
Number Sold:	1,600+

Vendor: StarBase Corporation

In Business Since:	
Address:	18872 MacArthur Blvd. Suite 400, Irvine CA, 92715
Marketing Contact:	
Phone Number:	714-442-4400
Fax Number:	714-253-6712
E-mail Address:	CompuServe 73531,137
Bulletin Board System:	
Customer Support:	714-442-4460
Training Provided:	Yes, for fee
Consulting Support:	Yes, for fee
Customization:	No
By Vendor:	No
By User:	No

Pricing:

Single User Price:	$279
Site License:	See below *
Multicopy Price:	See below *
GSA Price:	N/A
Maint. Price:	N/A

Platform(s)/Operating System(s):

* Multicopy price information: 1-4 units $279, 5-9 units $250, 10-19 units $235, 20-49 units $225, and 50+ units - call.

Windows, Windows for Workgroups, Windows NT

Minimum/Recommended Configuration: (RAM size, Disk size, User Interface, Network, etc.)

An IBM or 100% compatible computer with an 80386 or higher processor. 4 MB available RAM, 2 MB available hard disk space. VGA or higher resolution monitor. A mouse or compatible pointing device. MS-DOS version 5.0 or higher, and Microsoft Windows Version 3.1 or higher, Windows for Workgroups 3.11, or Windows NT 3.1.

Tool Integration: (CASE tools, Frameworks, Databases, Compilers, Documentation tools, etc.)

N/A

Description/Purpose: (Identify support for Ada, 2167A)

VERSIONS provides a fast, easy-to-use solution to your version control needs. Designed to make version control as simple as possible, VERSIONS has it all; easy-to-use project metaphor, automated "smart" suggestions for file check-in/check-out, automatic project-based scheduled file check-in, long-term file locking, quick versioning of files - even Windows' binaries, diffing and delta versioning for ASCII files, hassle-free reports, and use of DOS command-line for batch ops. Fully network compatible. Runs under Windows, Windows for Workgroups, and Windows NT.

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APPENDIX D

User Critiques

PRODUCT CRITIQUE

Product Name:	**ChangeMan**	**Version Number:**	**3.3.2**
Vendor Name:	Serena Intl.	Hardware Platform:	IBM
Special Operating Environment:		Operating System:	MVS

Reviewer's Name:	David Marks	Position/Title:		Administrator/Project Leader	
Company/Organization:	NWNL	Office/Group:			
Address:	111 Washington Ave. Mols, MN 55402	Reviewer's Duties:		Install, Implement	
		Project Description:		Install and implement ChangeMan product	
Phone:	612-342-3085	Fax:	612-342-3058	Email:	SYSM

Years of software experience:	6	Overall impression of this product:	Good
Years of experience with product:			
Last time product was used:	In use		
Keep name and company confidential?	No	Quality of Vendor Support:	Fair
Will you use this product on your next project?			
Do you prefer another product?			

Notable Strengths of this Product:
Simple, relatively straight forward, easily customized.

Notable Weaknesses of this Product:
Seems to be too mainframe oriented; does not address multiple platform applications; performance could be better; support could be better.

Advice for Potential Users or Buyers of this Product:

Vendor Comments:
None

PRODUCT CRITIQUE

Product Name:	**ChangeMan**	**Version Number:**	**3.3.2**
Vendor Name:	Serena Intl.	Hardware Platform:	IBM 3090 Amdahl 5995
Special Operating Environment:	Operating System:	MVS/ESA	

Reviewer's Name:	Gail Kinney	Position/Title:		Information Sys Analyst
Company/Organization:	Duke Power Co.	Office/Group:		Info Technology Svcs
Address:	P.O. Box 1008, CS05A Charlotte, NC 28201-1008	Reviewer's Duties:		Corporate Application Support, ChangeMan Administrator
Phone:	704-382-9442	Fax:	704-382-9785	Email:PROFS,cc: MAIL
Project Description:	Change implementation manager, public utility environment.			

Years of software experience:	14	Overall impression of this product:	
Years of experience with product:	4		
Last time product was used:	In use		
Keep name and company confidential?	No	Quality of Vendor Support:	Good
Will you use this product on your next Project?	Yes	Do you prefer another product?	No

Notable Strengths of this Product:

* ChangeMan provides a lot of flexibility to allow each shop to tailor it to specific needs without a lot of work.
* It is easy to implement and can be phased in, no mass conversion is necessary.
* It handles remote site installations and DB2 components very well.

Notable Weaknesses of this Product:

* Documentation has been less than adequate up to now. Release 4.1.0, due out later this year, promises to significantly improve documentation.
* Instability of new releases has also tended to be a problem; however, more customers are now getting involved in beta testing.

Advice for Potential Users or Buyers of this Product:

* Can't think of any real dangers.
* ChangeMan is a complex product and you have to work with it a while to really appreciate all the things it can do.
* Glad to have chosen it over the other available products.
* Both the Optima and Serena people are great to work with. They listen to the needs of their customers.

Vendor Comments:

None.

PRODUCT CRITIQUE

Product Name:	**ChangeMan**	**Version Number:**	**3.3.2**
Vendor Name:	Serena Intl.	Hardware Platform:	Amdahl 5995
Special Operating Environment:	Operating System:	MVS/ESA 4.1	

Reviewer's Name:	Confidential	Position/Title:	Mgr, Tech Services
Company/Organization:	Confidential	Office/Group:	Information Services
Address:	Confidential	Reviewer's Duties:	Mainframe Software
Phone:	Confidential	Fax:	Email:
Project Description:			

Years of software experience:	24	Overall impression of this product:	Excellent
Years of experience with product:	3		
Last time product was used:	In use		
Keep name and company confidential?	Yes	Quality of Vendor Support:	Good
Will you use this product on your next Project?	Yes	Do you prefer another product?	No

Notable Strengths of this Product:

* Flexible. ChangeMan permits the shop to mold change control rather than forcing rigid procedures.
* Allows all changes to be done by one 'user id' rather than having all 'user ids' updating files.

Notable Weaknesses of this Product:

* Documentation, but it is being rewritten.

Advice for Potential Users or Buyers of this Product:

* Optima and Serena are both very receptive to suggestions and are easy to work with.

Vendor Comments:

None.

PRODUCT CRITIQUE

Product Name:	**ChangeMan**	**Version Number:**	**3.3.2**
Vendor Name:	Serena Intl.	Hardware Platform:	Amdahl 5890
Special Operating Environment:		Operating System:	MVS/ESA

Reviewer's Name:	Sonia Coe	Position/Title:	Systems Tech Analyst
Company/Organization:	North American Van Lines	Office/Group:	
Address:	5001 U.S. Hwy 30 W. Fort Wayne, IN 46818	Reviewer's Duties:	ChangeMan, Training, Development Ctr Support
Phone:	219-429-1929	Fax: 219-429-1762	Email:
Project Description:	All change management functions including interfacing with PAC (SAG product), QUICK-REF (Chicago Soft), and APS (Intersolv).		

Years of software experience:	17	Overall impression of this product:	Good
Years of experience with product:	4 to 5		
Last time product was used:	In use		
Keep name and company confidential?	No	Quality of Vendor Support:	Good
Will you use this product on your next Project?	Yes	Do you prefer another product?	No

Notable Strengths of this Product:

* Adaptable to your environment through skeleton and panel changes.

Notable Weaknesses of this Product:

* Need additional interfaces with other vendors and better testing before releases.
* Documentation should also be improved.

Advice for Potential Users or Buyers of this Product:

* Product has good potential for your own work. We are currently tying in several ways to software AG products and hope to do more in the future.

Vendor Comments:

None.

PRODUCT CRITIQUE

Product Name:	**Information Asset Mgt**	**Version Number:**	**3.0.2**
Vendor Name:	Atherton Technology	Hardware Platform:	SUN
Special Operating Environment:	Operating System:	SUN OS 4.1.3	

Reviewer's Name:	Gregory V. Braun	Position/Title:	Program Mgr
Company/Organization:	Loral Corporation	Office/Group:	Software Productivity Lab
Address:	3200 Zanker Road San Jose CA	Reviewer's Duties:	Manage development funding issues
Phone:	408-473-7978	Fax: 408-473-7131	Email: gvb@spl2spl.loral.com
Project Description:	Development of Loral Corporate Computer Aided Software Environment (CORCASE).		

Years of software experience:	16	Overall impression of this product:	Excellent
Years of experience with product:	4		
Last time product was used:	On-going		
Keep name and company confidential?	No	Quality of Vendor Support:	Excellent
Will you use this product on your next Project?	Yes	Do you prefer another product?	No

Notable Strengths of this Product:
Object-oriented CMS.
Extensible/Refinable.

Notable Weaknesses of this Product:
Lack of Adhoc Query Language.

Advice for Potential Users or Buyers of this Product:
Take advantage of available training and on-site support.

Vendor Comments:
None.

PRODUCT CRITIQUE

Product Name:	**Version Merger**	**Version Number:**	
Vendor Name:	Princeton Softech	Hardware Platform:	3390
Special Operating Environment:	Operating System:	MVS	

Reviewer's Name:	Confidential	Position/Title:	Systems Prog Specialist
Company/Organization:	Confidential	Office/Group:	
Address:	Confidential	Reviewer's Duties:	Install/Maintain Software
Phone:	Confidential	Fax:	Email:
Project Description:			

Years of software experience:	20	Overall impression of this product:	Excellent
Years of experience with product:	4		
Last time product was used:	Dec 93		
Keep name and company confidential?	Yes	Quality of Vendor Support:	Excellent
Will you use this product on your next Project?	Yes	Do you prefer another product?	No

Notable Strengths of this Product:

* Reduces time to identify changes/differences of software components.
* Easy to use.
* User friendly.
* Time and money saver for impact analysis, code documentation, coordination of software changes, and implementation of software changes.
* Easy to produce and read reports.
* Interaction with other software management tools such as Endevor, Librarian, Pan Valet, etc.

Notable Weaknesses of this Product:

N/A

Advice for Potential Users or Buyers of this Product:

* Installs easily.
* Tutorials are simple and easy to follow.
* Product is a must for application software and system software management.

Vendor Comments:

None.

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APPENDIX E

List of Standards

SOFTWARE CONFIGURATION MANAGEMENT STANDARDS

U.S. Department of Defense Publications

Publications available from:

Commander

Naval Publications and Forms Center

Code 3013

5801 Tabor Avenue

Philadelphia, PA 19120

DOD-STD-2167A, *Defense System Software Development*

DOD-STD-2168, Defense System Software Quality Program

DOD 5010.19, *Configuration Management*

Military Handbooks

MIL-HDBK-61, *Configuration Management*

MIL-HDBK-287, *Defense System Software Development*

Military Standards

MIL-STD-499A, *Engineering Management*

MIL-STD-881, *Work Breakdown Structures for Defense Material Items*

MIL-STD-973, *Configuration Management* (See Note)

Note: MIL-STD-973 is a consolidation of several CM standards. They include:

MIL-STD-480, *Engineering Change Proposals (ECP)*

MIL-STD-481, *Engineering Change Proposals* - short form

MIL-STD-482, *Status Accounting* (Data Elements, Only)

MIL-STD-483, (USAF), *Configuration Management*

MIL-STD-1456, *Configuration Management Plans*

MIL-STD-1521, *Reviews & Audits* (Audits only, Reviews are in MIL-STD-499B)

MIL-STD-2167A, *Defense Software Development* (CM related requirements)

IEEE Standards

Standards available from:

IEEE Service Center

445 Hoes Lane

Piscataway, NJ 08855-1331

1-800-678-IEEE

IEEE Std 610.12-1990, *Glossary of Software Engineering Terminology*

IEEE Std 828-1990, *Standard for Software Configuration Management Plans*

IEEE Std 1028-1988, *Standard for Software Reviews and Audits*

IEEE Std 1042-1986, *Guide for Software Configuration Management*

IEEE Std 1063-1987, *Standard for User Documentation*

IEEE Std 1074-1991, *Standard for Developing Software Life Cycle Processes*

Electronic Industry Association (EIA) Publications

Publications available from:

Electronic Industry Association

2001 Pennsylvania Avenue NW

Washington, DC 20006

202-257-4985

CMB4-1A, *Configuration Management Definitions for Digital Computer Programs*

CMB4-2, *Configuration Identification for Digital Computer Programs*

CMB4-4, *Configuration Change Control for Digital Computer Programs*

CMB5-A, *Configuration Management Requirements for Subcontractors/Vendors*

CMB6-1B, *Configuration and Data Management References*

CMB6-2, *Configuration and Data Management In-House Training Plan*

CMB6-3, *Configuration Identification*

CMB6-4, *Configuration Change Control*

CMB6-5, *Textbook for Configuration Status Accounting*

CMB6-6, *Textbook for Audits and Reviews*

CMB6-9, *Configuration and Data Management Training Course*

CMB6-10 *Education in Configuration and Data Management*

CMB7-1, *Electronic Interchange of Configuration Management Data*

CMB7-2, *Guideline for Transitioning Configuration Management to an Automated Environment*

CMB7-3, *CALS/Configuration Management Statement of Work*

International Standards Organization (ISO) Standards

ISO/IEC JTC1/SC7/WG8/P.7.23, *Software Configuration Management*

ISO/IEC TC176/SC2/WG14/N21, *Configuration Management Conference*

ISO 9000, *Quality Assurance - Part 3, Software Configuration Management*

APPENDIX F

References and Recommended Reading

References and Recommend Reading

[ANSI/IEEE 87]
ANSI/IEEE Std 1042-1987, *American National Standard IEEE, Guide to Software Configuration Management*, Institute of Electrical and Electronics Engineers, Inc., New York, NY, 1988.

[Ayer, Patrinostro 92]
Ayer, Steve J., and Frank S. Patrinostro, *Software Configuration Management: Identification, Accounting, Control, and Management*, McGraw-Hill software engineering series, McGraw-Hill, Inc., 1992.

[Babich 86]
Babich, Wayne A., *Software Configuration Management: Coordination for Team Productivity*, Addison-Wesley Publishing Company, Inc., 1986.

[Berlack 92]
Berlack, Ronald H., *Software Configuration Management*, John Wiley & Sons, Inc., 1992.

[Buckley 92]
Buckley, Fletcher J., *Implementation Configuration Management: Hardware, Software, and Firmware,* IEEE Press, 1993.

[Conner 82]
Conner, Daryl R., and Robert W. Patterson, "Building Commitment to Organizational Change," *Training and Development Journal*, Vol. 36, Number 4, April, 1982, pp. 18-30.

[Dart 90]
Dart, Susan A., "Issues in Configuration Management Adoption," *Proceedings of Conference on Caseware,* Software Engineering Institute Overview, Carnegie Mellon University, Pittsburgh, PA.

[Dart 92]
Dart, Susan A., "State-of-the-Art in Environment Support for Configuration Management," *ICSE 14 Tutorial*, Australia, Carnegie Mellon University, Pittsburgh, PA, May 1992.

[Dart 92]
Dart, Susan A., *The Past, Present, and Future of Configuration Management,* Technical Report CMU/SEI-92-TR-8, ESC-TR-92-8, Software Engineering Institute, Carnegie Mellon University, July 1992.

[Dart 94]
Dart, Susan A., *Adopting An Automated Configuration Management Solution,* Proceedings of Software Technology Conference, April 1994.

[DeGrace, Stahl 90]
DeGrace, Peter, and Leslie Hulet Stahl. "Wicked Problems, Righteous Solutions," *A Catalogue of Modern Software Engineering Paradigms,* Yourdon Press, Englewood Cliffs, NJ, 1990.

[Feiler 91]
Feiler, Peter H., *Configuration Management Models in Commercial Environments,* Technical Report CMU/SEI-91-TR-7, ESD-9-TR-7, Software Engineering Institute, Carnegie Mellon University, March 1991.

[Feiler, Downey 90]
Feiler, Peter H., and Grace Downey, *Transaction-Oriented Configuration Management: A Case Study,* Technical Report CMU/SEI-90-TR-23, ESD-90-TR224 Software Engineering Institute, Carnegie Mellon University, November 1990.

[Firth, et al. 87]
Firth, Robert, et al., *A Guide to the Classification and Assessment of Software Engineering Tools,* Technical Report CMU/SEI-87-TR-10, ESD-TR-87-111, Software Engineering Institute, Carnegie Mellon University, August 1987.

[Forte 90]
Forte, Gene, "Configuration Management Survey," *CASE Outlook* 90(2), 1990.

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Fowler, Pricilla and Stan Przybylinski. "Transferring Software Engineering Tool Technology," IEEE Computer Society Press, Washington D.C., 1988.

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Humphrey, Watts S., *Managing the Software Process,* Addison-Wesley Publishing Company, August 1990.

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[Ingram, Burrows, Wesley 93]
Ingram, Pat, Clive Burrows, and Ian Wesley, *Configuration Management Tools: a Detailed Evaluation.* Ovum Limited, 1993.

[Olson, Timothy, et al. 93]
Olson, Timothy G., et al., *A Software Process Framework for the SEI Capability Maturity Model: Repeatable Level,* Technical Report CMU/SEI-93-SR-7, Software Engineering Institute, Carnegie Mellon University, Pittsburgh, PA, 1993.

[Rader, Morris, Brown 93]
Rader, Jock, Ed J. Morris, and Alan W. Brown, *An Investigation into the State-of-the-Practice of CASE Tool Integration,* Technical Report CMU/SEI-93, Software Engineering Institute, Carnegie Mellon University, 1993.

[Slomer, Christie 92]
Slomer, Howard M., and Alan M. Christie, *Analysis of a Software Maintenance System: A Case Study,* Technical Report CMU/SEI-92-TR-31, ESC-TR-92-031, Software Engineering Institute, Carnegie Mellon University, November 1992.

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Smith, Dennis, et al., *Software Engineering Environment Evaluation Issues,* Technical Report CMU/SEI-93, Software Engineering Institute, Carnegie Mellon University, March 1993.

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Softool Corporation, *Successful Software Strategies Seminar Series: Improving Your Configuration Management Implementation Strategy,* Washington, D.C., 1992.

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Wallnau, Kurt C., *Issues and Techniques of CASE Integration with Configuration Management,* Technical Report CMU/SEI-92-TR-5, ESD-TR-92-5, Software Engineering Institute, Carnegie Mellon University, March 1992.

[Whitgift 91]
Whitgift, David, *Methods and Tools for Software Configuration Management,* John Wiley & Sons Ltd., 1991.

APPENDIX G

Glossary

Glossary

Architecture - The organizational structure of a system or component [IEEE 90].

Audit - An independent examination of a work product or set of work products to assess compliance with specifications, standards, contractual agreements, or other criteria [IEEE 90].

Baseline - A specification or product that has been formally reviewed and agreed upon, that thereafter serves as the basis for further development, and that can be changed only through formal change control procedures [IEEE 90].

Complexity - The degree to which a system or component has a design or implementation that is difficult to understand and verify [IEEE 90].

Computer-Aided Software Engineering (CASE) - The use of computers to aid in the software engineering process. May include the application of software tools to software design, requirements tracing, code production, testing, document generation, and other software engineering activities [IEEE 90].

Configuration - The functional and physical characteristics of hardware or software as set forth in technical documentation or achieved in a product [IEEE 90].

Configuration Control - An element of configuration management, consisting of the evaluation, coordination, approval or disapproval, and implementation of changes to configuration items after formal establishment of their configuration identification [IEEE 90].

Configuration Control Board (CCB) - A group of people responsible for evaluation and approving or disapproving proposed changes to configuration items, and for ensuring implementation of approved changes [IEEE 90].

Configuration Identification - An element of configuration management, consisting of selecting the configuration items for a system and recording their functional and physical characteristics in technical documentation [IEEE 90].

Configuration Item (CI) - An aggregation of hardware, software, or both, that is designated for configuration management and treated as a single entity in the configuration management process [IEEE 90].

Configuration Item Development Record - A document used in configuration management, describing the development status of a configuration item based on the results of configuration audits and design reviews [IEEE 90].

Configuration Management (CM) - A discipline applying technical and administrative direction and surveillance to: identify and document the functional and physical characteristics of a configuration item, control changes to those characteristics, record and report change processing and implementation status, and verify compliance with specified requirements [IEEE 90].

Configuration Status Accounting - An element of configuration management, consisting of the recording and reporting of information needed to manage a configuration effectively. This information includes a listing of the approved configuration identification, the status of proposed changes to the configuration, and the implementation status of approved changes [IEEE 90].

Functional Configuration Audit - An audit conducted to verify that the development of a configuration item has been completed satisfactorily, that the item has achieved the performance and functional characteristics specified in the functional or allocated configuration identification, and that its operational and support documents are complete and satisfactory [IEEE 90].

Hierarchy - A structure in which components are ranked into levels of subordination; each component has zero, one, or more subordinates; and no component has more than one superordinate component [IEEE 90].

Interface - A hardware or software component that connects two or more other components for the purpose of passing information from one to the other [IEEE 90].

Module - A program unit that is discrete and identifiable with respect to compiling, combining with other units, and loading; for example, the input to, or output from, an assembler, compiler, linkage editor, or executive routine [IEEE 90].

Physical Configuration Audit (PCA) - An audit conducted to verify that a configuration item, as built, conforms to the technical documentation that defines it [IEEE 90].

Product Configuration Identification - The current approved or conditionally approved technical documentation defining a configuration item during the production, operation, maintenance, and logistic support phases of its lifecycle. It prescribes all necessary physical or form, fit, and function characteristics of a configuration item, the selected functional characteristics designated for production acceptance testing, and the production acceptance tests [IEEE 90].

Quality Assurance (QA) - A planned and systematic pattern of all actions necessary to provide adequate confidence that an item or product conforms to established technical requirements [IEEE 90].

Software Engineering Environment - The hardware, software, and firmware used to perform a software engineering effort. Typical elements include computer equipment, compilers, assemblers, operating systems, debuggers, simulators, emulators, test tools, documentation tools, and database management systems [IEEE 90].

Software Library - A controlled collection of software and related documentation designed to aid in software development, use, or maintenance. Types include master library, production library, software development library, software repository, and system library [IEEE 90].

Software Lifecycle - The period of time that begins when a software product is conceived and ends when the software is no longer available for use. The software lifecycle typically includes a concept phase, requirements phase, design phase, implementation phase, test phase, installation and checkout phase, operation and maintenance phase, and sometimes, retirement phase [IEEE 90].

APPENDIX H

Acronyms

Acronyms

AF	-	Air Force
AFSCM	-	Air Force Systems Command Manual
ASCII	-	American Standard Code for Information Interchange
ASSET	-	Asset Source for Software Engineering Technology
CALS	-	Computer-Aided Acquisition and Logistic Support
CASE	-	Computer-Aided Software (or Systems) Engineering
CSCI	-	Computer Software Configuration Item
CM	-	Configuration Management
CMM	-	Capability Maturity Model
CMU	-	Carnegie Mellon University
DARPA	-	Defense Advanced Research Projects Agency
DoD	-	Department of Defense
ECS	-	Electronic Customer Services
EIA	-	Electronic Industry Association
ESIP	-	Embedded Computer Resources Support Improvement Program
FCA	-	Functional Configuration Audit
GUI	-	Graphical User Interface
HCM	-	Hardware Configuration Management
IEEE	-	Institute of Electrical and Electronics Engineers
IPSE	-	Integrated Project Support Environment
ISO	-	International Standards Organization

LAN	-	Local Area Network
MIS	-	Management Information System
NASA	-	National Aeronautics and Space Administration
PC	-	Personal Computer
PCA	-	Physical Configuration Audit
PCTE	-	Portable Common Tool Environment
QA	-	Quality Assurance
RCS	-	Revision Control System
SCCS	-	Source Code Control System
SCML	-	Software Configuration Manager Library (IBM)
SCM	-	Software Configuration Management
SEI	-	Software Engineering Institute
SQA	-	Software Quality Assurance
SQL	-	Software Query Language
STARS	-	Software Technology for Adaptable, Reliable Systems
STC	-	Software Technology Conference
STD	-	Standard
STSC	-	Software Technology Support Center
WWISCUC	-	World Wide Information System Common User Contract
WWMCCS	-	World Wide Military Command and Control System

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APPENDIX I

STSC Overview

1.1 The Software Technology Support Center

The mission of the Software Technology Support Center (STSC) is to transition technologies and exchange information to help DOD Software Development and Support Activities continuously improve their software quality and life cycle productivity.

A planned approach is necessary for successful transition. In general, transitioning effective practices, processes, and technologies consists of a series of activities or events that occur between the time a person encounters a new idea and the daily use of that idea. Conner and Patterson's Adoption Curve [Conner 82], shown in Figure 1-1, illustrates these activities.

After encountering a new process or technology, potential customers of that technology increase their awareness of its usage, maturity, and application. If the process or technology is promising, then customers try to better understand its strengths, weaknesses, costs, and applications. These first activities in the Adoption Curve take a significant amount of time.

Next, the customer evaluates and compares the processes and technologies that show the most promise. To reduce the risk, customers usually try new processes or technologies on a limited scale through beta tests, case studies, or pilot projects. A customer then adopts processes or technologies that prove effective. Finally, refined processes and technologies become essential parts of an organization's daily process (institutionalization).

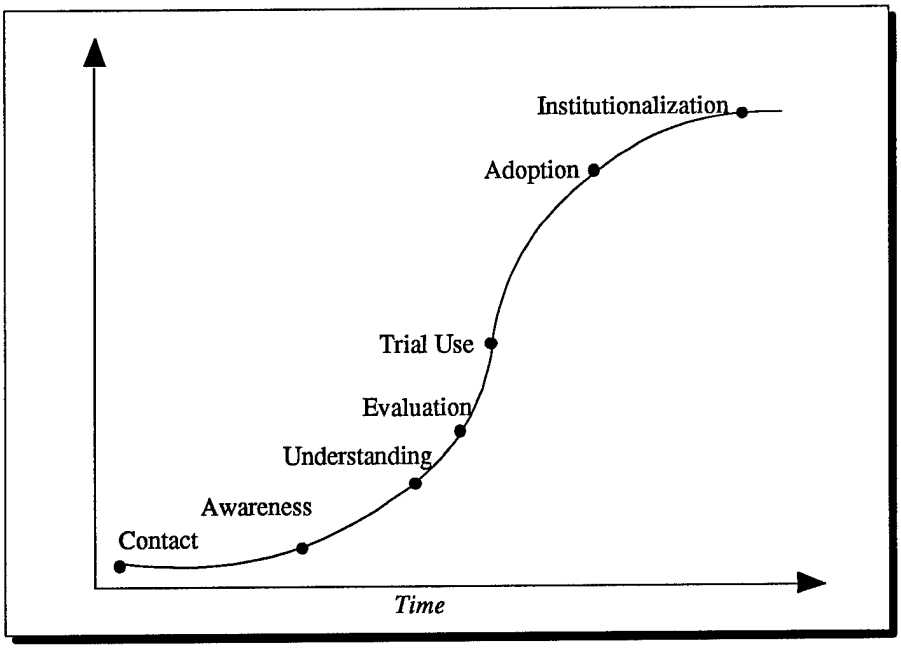

Figure 1-1. Adoption Curve

Word processors are essential in most organization's daily operations. Yet, thirty years ago they did not exist. The institutionalization of word processors in many organizations followed a series of events similar to those identified in the Adoption Curve.

The STSC is researching and collecting information about technologies that will reduce the time and resources it takes to become aware, understand, evaluate, test, try, and adopt effective practices, processes, and technologies. The STSC has developed the following objectives to accomplish its mission:

- Technology Evaluation
  Identify, validate, classify, and evaluate effective processes and technologies.

- Information Exchange
  Facilitate the exchange of better software business practices, processes, and technologies within the DOD.

- Insertion Projects
  Analyze and improve processes, adopt new methodologies as needed, evaluate and select effective tools, receive appropriate levels of training,

and perform pilot projects to try out and confirm the technology insertion efforts.

- STSC Associates
  Develop STSC Associates who can infuse effective process and technology improvements through the use of STSC products, services, and processes.

1.2 STSC Technology Transition Approach

This section describes the STSC's approach to meeting the objectives identified in the previous section.

1.2.1 Technology Evaluation

The first technology transition objective involves identifying, validating, and classifying processes, methods, and technologies that can potentially improve the quality or productivity of software development and maintenance. Many organizations are so focused on deadlines and customer needs that they lack the resources and time to thoroughly investigate options for improvement, leaving them vulnerable to marketing hype. The STSC has developed the infrastructure to provide information on all types of applicable technologies. Product critiques, which are essentially brief evaluations from experienced technology users, are collected. Quantitative evaluations, which are detailed, comparable, and objective, are performed on the most promising tools, methods, or processes.

1.2.2 Information Exchange

This technology transition objective involves exposing potential customers to available technologies and, conversely, customer requirements to technology developers. Referring to the Adoption Curve, this objective focuses on contact, awareness, and understanding. STSC products that accomplish this objective include *CrossTalk* (a monthly technology report), the annual Software Technology Conference, specific technology reports, and electronic customer services.

1.2.2.1 *CrossTalk*

Over 14,000 software professionals receive *CrossTalk* monthly. This publication provides a forum for the exchange of ideas. Articles cover leading edge, state-of-the-art, and state-of-the-practice processes and technologies in software engineering.

1.2.2.2 *Software Technology Conference*

The annual Software Technology Conference is held each April in Salt Lake City, Utah. This conference brings together over 2,000 software professionals from government, industry, and academia to share technology solutions and exchange ideas and information.

1.2.2.3 *Technology Reports*

STSC technology reports provide detailed information on specific software engineering technologies. The current list of reports include:

- Process Technologies Methods and Tool Report
- Test Preparation, Execution, and Evaluation
- Documentation
- Project Management
- Software Cost Estimation
- Requirements Analysis and Design
- Reengineering
- Source Code Static Analysis
- Software Engineering Environments
- Software Management Guide

These reports provide awareness and understanding of each topic in preparation for evaluation and selection of corresponding technologies.

1.2.2.4 *Electronic Customer Services*

Along with the services mentioned above, the STSC also provides customers with electronic access to information via Electronic Customer Services (ECS). ECS includes a bulletin board system which is available to obtain additional information, leave messages, add information, and confer electronically. In addition, a computerized database of practice, process, and technology information is coming on-line. ECS can be accessed via the INTERNET at address 137.241.33.1 or stscbbs.al.mil or by calling 801-774-6509 with modem at 2400 or 9600 baud, 8 bit word, 1 stop bit, and no parity.

1.2.3 Technology Insertion Projects

STSC technology insertion projects are customer oriented projects that evaluate, select, and pilot the use of new processes, methods, and technologies for a specific customer. These projects can include process definition, process improvement, methodology insertion, tool insertion, and development of a technology road map. Referring to the Adoption Curve, Figure 1-1, an insertion project helps cement understanding of a process or technology, tailors an evaluation of the process or technology for the customer, and pilots the use of that process or technology with appropriate levels of training. Customers move closer to adoption of the process or technology through hands-on experience. It is important to try out technology improvements in a pilot project to confirm that the technology is appropriate for the organization and that the organization is ready and able to adopt the new technology.

1.2.4 STSC Associates

Fowler and Przybylinski [Fowler 88] propose that transitioning new technologies from a developer to a consumer requires an advocate to push the technology and a receptor to pull the technology into an organization. This concept is illustrated in Figure 1-2.

Effective change comes from within the organization. The STSC Associates objective is to develop technology receptors within individual Air Force SDSAs. These receptors, STSC Associates, are trained in the use of the STSC's information, products, and services to enhance their organization's ability to incorporate advanced practices, processes, and technologies.

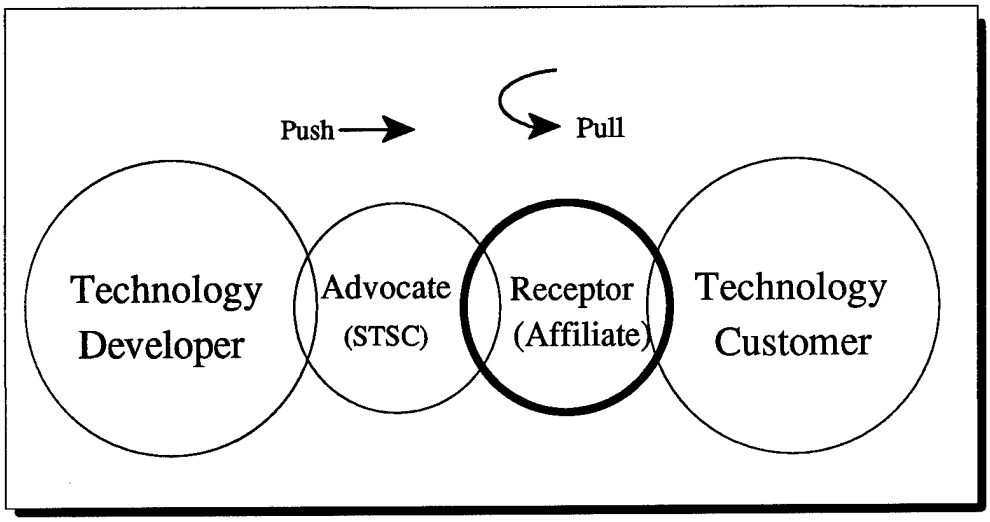

Figure 1-2. Transitioning Technology

Referring to the Adoption Curve in Figure 1-1, STSC Associates complete the trek to institutionalization. Associates coming from within the organization should be politically astute and aware of internal organizational requirements. They have the highest probability of influencing the adoption and daily use of effective business practices, processes, and technologies.

1.3 Embedded Computer Resources Support Improvement Program (ESIP)

The STSC operates out of the Ogden Air Logistics Center at Hill Air Force Base, Utah, under the direction and guidance of the ESIP Steering Group. An Air Force program, the ESIP has the goals of reducing the software backlog and increasing software quality and productivity. Its mission is to provide an infrastructure to assist in the transitioning of technology to support all categories of embedded computer systems throughout the acquisition cycle and improve the readiness of Air Force weapon systems. ESIP is directed by an Air Force program management directive (PMD3118) and is led by a major command level steering group. The steering group had representation from the following organization: AFMC, AFSPACECOM, USSTRATCOM, ACC, AFOTEC. The voting members of ESIP are:

Col Charles Fuller, DSN 458-2435, commercial 801-777-2435, fax DSN 458-9034

Capt Mike Helsabeck, DSN 576-8189, commercial 618-256-8189, fax DSN 576-8939

Capt Jonathan Liles, DSN 787-2151, commercial 513-257-2151, fax DSN 787-0841

Maj Barbara Nelson, DSN 692-5054, commercial 719-554-5054, fax DSN 692-3350

Capt Sean O'Connell, DSN 271-3278, commercial 402-294-3278, fax DSN 271-1020

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Mr. Jeffrey Wiltse, DSN 246-5310, commercial 505-846-5310, fax DSN 246-5145